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DENVER RADIUM SITE
OPERABLE UNIT VIII

CONSTRUCTION COMPLETION REPORT

VOLUME 1 OF 3

The S.W. Shattuck Chemical Company, Inc.
February 8, 1999

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EXECUTIVE SUMMARY

In August 1992, the Environmental Protection Agency (EPA) issued an order to The S.W. Shattuck Chemical Company, Inc. (Shattuck) pursuant to section 106(a) of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA). The order required Shattuck to perform the remedial action selected by EPA and the Colorado Department of Public Health and Environment (CDPHE) in the Record of Decision (ROD) issued on January 28, 1992 for Operable Unit VIII of the Denver Radium Site. Shattuck agreed to perform the remedial action as ordered by EPA and began its implementation in September 1992.

The Denver Radium Site consists of over 40 properties located in 12 different areas within the City and County of Denver. In order to manage the CERCLA process, EPA divided the Denver Radium Site into 12 Operable Units (OU's), generally based upon location. Shattuck's property at 1805 South Bannock Street (Bannock Street Site or Site) was included in OU VIII, which is located northeast of the intersection of Evans Avenue and Santa Fe Drive. Operable Unit VIII consists of Shattuck's Bannock Street Site, the railroad right-of-way to the west of the Site and nearby vicinity properties. The area is zoned commercial/industrial and is predominately used for commercial and industrial purposes.

EPA and CDPHE conducted extensive remedial investigations at OU VIII to determine the nature and extent of contamination. In addition to EPA's and CDPHE's investigations, Shattuck collected extensive data for the Bannock Street Site, including soil and groundwater sampling. Shattuck also installed and sampled groundwater monitoring wells off-site and downgradient of the Bannock Street Site. Additionally, treatability studies were conducted as a part of the Feasibility Study.

Based upon the remedial investigations and the Feasibility Study, EPA and CDPHE issued the ROD on January 28, 1992, selecting on-site stabilization and solidification as the remedy for OU VIII. The remedy included the following components:

- Demolition and off-site disposal of the then-existing buildings and facilities on the Bannock Street Site;
- Excavation of contaminated soils from the railroad right-of-way and the vicinity properties and stockpiling of those soils on the Bannock Street Site;
- Excavation of the soils from the Bannock Street Site, consolidation, stabilization and solidification of all of the contaminated soils and placement into a monolith;

- Capping of the monolith; and
- Institutional controls, maintenance and groundwater monitoring.
- Remediation of portions of storm sewer that may be impacted by groundwater from OU VIII.

In 1986 Congress amended CERCLA with the enactment of the Supplemental Amendments and Reauthorization Act (SARA). In the amendments, Congress stated a preference for both remedial actions requiring treatment and for the use of treatment versus off-site disposal. Section 121(b) provides that "[r]emedial actions in which treatment which permanently and significantly reduces the volume, toxicity or mobility of the hazardous substances, pollutants or contaminants is a principle element, are to be preferred over remedial actions not involving such treatment." Section 121(b) further provides that "[t]he off-site transport and disposal of hazardous substances or contaminated materials without such treatment should be the least favored alternative remedial action where practicable treatment technologies are available."

Following the selection of the remedy, EPA issued the unilateral "Administrative Order for Remedial Design/Remedial Action," dated August 21, 1992 (UAO), to Shattuck. To perform the requirements of the UAO, Shattuck retained national environmental remediation design and construction firms. These firms brought highly qualified project, health and safety, and quality control managers and personnel to the project. Throughout the project, EPA and CDPHE conducted extensive oversight of the remediation activities. During Phase II of the remediation, which included the stabilization and solidification of contaminated soils, the agencies conducted full-time oversight of the remediation activities through the services of Morrison-Knudsen, a national environmental engineering and construction firm.

Following the completion of the construction of the cover system on the monolith, radiation surveys were conducted. The surveys for gamma radiation, radon flux on top of the monolith, and radon concentrations at the property boundary showed levels equivalent to background levels and well below applicable standards. The data demonstrates that the remedy has been effectively constructed and is protective of public health and the environment.

This Construction Completion Report describes the activities performed to meet the requirements of the UAO. The Report also describes the quality assurance/quality control measures taken to ensure that the UAO requirements were met. The information provided in the Report demonstrates that the construction of the remedial action for OU VIII was completed in accordance with the Statement of Work and the RD/RA Work Plan.

LIST OF ACRONYMS AND ABBREVIATIONS

AAL – above action level

Acculabs – Acculabs Research, Inc. of Golden, Colorado

ACM – asbestos containing material

ARARs – applicable or relevant and appropriate requirements

Arrow – Arrow Engineering and Surveying, Inc. of Denver, Colorado

BAL – below action level

CDPHE – Colorado Department of Public Health and Environment

CERCLA – the Comprehensive Environmental Response, Compensation and Liability Act of 1980, 42 U.S.C.A. § 9601 et. seq.

CQAP – Construction Quality Assurance Plan

DOT – Department of Transportation

ESC/AWS – Earth Sciences Consultants, Inc./AWS Remediation, Inc.

EPA – Environmental Protection Agency

FAPM – Field Activities Procedure Manual prepared for EPA by ChemNuclear Geotech to guide cleanup of uranium mill tailings sites

FDGTI – Fluor Daniel GTI

GCL – geosynthetic clay liner

HLA – Harding Lawson Associates

IPMP – Interim Plume Monitoring Program

JCA – Joe Cesare and Associates

MK – Morrison Knudsen

NCP – National Oil and Hazardous Substances Pollution Contingency Plan

NIST – National Institute of Science and Technology

NOAA – National Oceanographic and Atmospheric Administration

NRC – Nuclear Regulatory Commission

OCS – Opposed Crystal System

ORC – oxygen release compound

OU VIII – Operable Unit VIII of the Denver Radium Site

PM-10 – total suspended particulates equal to or less than 10 microns in diameter

PVC – polyvinyl chloride

QAPP – Quality Assurance Project Plan

QA/QC – quality assurance/quality control

RAS Samplers – Regulated Air Samplers

RCRA – Resource Conservation and Recovery Act of 1976, 42 U.S.C.A. § 6901 et. seq.

RD/RA – Remedial Design/Remedial Action

ROD – the Record of Decision for Denver Radium Site, Operable Unit VIII, dated January 28, 1992

RSCL – recompacted soil clay layer

SAP – Sampling and Analysis Plan

Site – the Bannock Street Site located at 1805 South Bannock Street in Denver, Colorado

S/S – stabilization/solidification treatment

TPH – total petroleum hydrocarbons

TSP – total suspended particulates

UAO – the unilateral "Administrative Order for Remedial Design/Remedial Action," dated August 21, 1992

I. INTRODUCTION

I.A. Purpose of Report

This Construction Completion Report presents the remedial design/remedial action (RD/RA) construction activities that were performed by The S.W. Shattuck Chemical Company, Inc. (Shattuck) at Operable Unit VIII of the Denver Radium Site (OU VIII). The remedial activities were performed by Shattuck pursuant to a unilateral "Administrative Order for Remedial Design/Remedial Action" dated August 21, 1992 (UAO), issued by the Environmental Protection Agency (EPA) pursuant to section 106(a) of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). On September 8, 1992, Shattuck agreed to perform the remedial action ordered by EPA in the UAO and began implementation of the remediation. EPA's estimated cost of the remedy was $26,600,000. At the time of this Report, Shattuck has spent in excess of $26,000,000 to perform the remediation.

I.B. Description of OU VIII

The Denver Radium Site includes eleven operable units (OUs) that comprise more than 40 properties located within the City and County of Denver. OU VIII is located in southwest Denver, northeast of the intersection of Evans Avenue and Santa Fe Drive. OU VIII includes: (1) a 5.9 acre tract located at 1805 South Bannock Street (Bannock Street Site or Site) owned by Shattuck; (2) a 4.3 acre railroad right-of-way located to the west of the Bannock Street Site; and (3) nearby vicinity properties located within the area bounded by South Santa Fe Drive, South Broadway, West Jewell Avenue and West Mexico Avenue (Figure 1).

OU VIII is located within an area zoned by the City and County of Denver for commercial/industrial uses and is bounded by such uses. The western property line of the Bannock Street Site is adjacent to active railroad lines. To the west of the railroad lines is South Santa Fe Drive. Flanagan Ready Mix occupies the property to the north of the Site. Several commercial/industrial operations are located on the south and east sides of the Bannock Street Site. Land use within several blocks south and east of the Bannock Street Site is predominantly commercial/industrial with a few residences in the area. Figure 2 identifies specific commercial and industrial businesses located in the area of the Bannock Street Site.

I.C. Operating History of Site

Operations at the Bannock Street Site began in 1918 and involved the processing of various minerals by various owners and operators during the Site's history. From the mid 1920's to 1933, the mineral processing activities at the Site principally involved the processing of carnotite and other ores for the recovery of vanadium and molybdenum compounds.

From 1934 to 1942, the primary focus of operations at the Site was on the processing for radium of residues produced from the processing of mining ores for vanadium. The vanadium processing residues were brought to the Site from North Continent Mines in southwestern Colorado. The residues were stored and processed and then disposed on-site. This radium processing took place under the prior ownership of the Site. No radium was produced at the Site at any time after 1942. From 1942 to 1950, the processing activities at the Site principally involved molybdenum compounds. There is a lack of information for the period of 1950 to 1955.

Beginning in 1955, in addition to molybdenum processing, bench scale uranium processes were conducted at the Site to produce small quantities of refined uranium chemicals. The uranium processes were conducted pursuant to a Radioactive Materials License (License No. Colo. SMB-479). The molybdenum and refined uranium chemical production continued through 1969. On December 31, 1969, the S.W. Shattuck Chemical Company sold certain assets, including the property and corporate name to the present owner, The S.W. Shattuck Chemical Company, Inc.

From 1970 into 1984, under the current ownership, molybdenum compounds, rhenium and, to a lesser extent, small quantities of refined uranium products under a radioactive materials license, were produced. After 1984, small quantities of refined uranium products were produced to use up inventory until 1986, at which time all operations ceased.

I.D. Regulatory Action Relative to OU VIII

Since 1983, EPA and the Colorado Department of Public Health and Environment (CDPHE) have conducted extensive investigations of Operable Unit VIII pursuant to CERCLA and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) to determine the nature and extent of any contamination. Shattuck also has collected extensive data for the Site including soil sampling and years of groundwater monitoring data. In July 1988, Shattuck submitted to EPA a compilation of its soil sampling and groundwater monitoring data. In November 1988, CDPHE, with grants made by EPA, initiated a further remedial investigation for OU VIII. The remedial investigation included evaluation of the existing data and collection of additional data to further characterize the nature and extent of the contamination.

The remedial investigation identified the occurrence of radioactive soil contamination on the Bannock Street Site, the railroad right-of-way, and the vicinity properties. The primary concern at OU VIII was found to be exposure to radon gas and gamma radiation, both of which are attributable to the radium contaminated soil. A feasibility study was prepared to analyze the various alternatives for remedial actions for OU VIII. On and off-site alternatives were extensively reviewed by both EPA and CDPHE.

In April 1991, EPA published the Proposed Plan for the remedial action at OU VIII. Following issuance of the Proposed Plan there was a 60-day public comment period as required by CERCLA. During the comment period, EPA received numerous comments from interested parties including Shattuck, various individuals and the City and County of Denver. Denver submitted additional comments after the public comment period. EPA considered the comments in the selection of the remedy and prepared a "Detailed Responses to Comments, Denver Radium Site, Operable Unit VIII" which is part of the Administrative Record for OU VIII.

On January 28, 1992, EPA and CDPHE jointly issued the Record of Decision (ROD) for OU VIII. The ROD set forth on-site stabilization and solidification as the remedy selected for the radium contaminated soils. The ROD also included a Responsiveness Summary which summarized the significant comments received during the public comment period. The ROD was supported by an extensive administrative record on which EPA and CDPHE relied in selecting the remedy.

The UAO issued to Shattuck on August 21, 1992 and effective August 31, 1992, requires Shattuck to perform the selected remedy at OU VIII as described in the ROD. The on-site stabilization and solidification remedy includes the following components:

- Demolition and off-site disposal of the then-existing buildings and facilities on the Bannock Street Site;
- Excavation of contaminated soils from the railroad right-of-way and the vicinity properties and stockpiling of those soils on the Bannock Street Site.
- Excavation of the soils from the Bannock Street Site, consolidation, stabilization and solidification of all of the contaminated soils and placement into a monolith; ,
- Capping of the monolith; and
- Institutional controls, maintenance and groundwater monitoring.

In addition, the ROD requires that Shattuck remediate the storm sewer west of the Site.

II. SCOPE OF COMPLETION REPORT

This report describes the remedial activities performed pursuant to the UAO. The remedial activities were divided into two phases. Phase I involved the demolition of the existing buildings and facilities on the Bannock Street Site. Phase I also included excavation of soils from the railroad right-of-way and vicinity properties. These soils were stockpiled at the Bannock Street Site for consolidation into the monolith during the second phase of the remedial activities.

Phase II of the remedial action involved excavation of the soils from the Bannock Street Site, treatment of those soils along with the soils from the railroad and vicinity properties with a mixture of cement and fly ash, incorporation of the treated materials into a monolith and capping of the monolith. Phase II activities also included remediation of the storm sewer and construction of monolith and plume monitoring wells.

Shattuck retained Earth Sciences Consultants, Inc, (Earth Sciences) and its affiliate CRS Remediation, Inc. (which later became AWS Remediation, Inc.) to perform the remedial action. Earth Sciences and CRS Remediation prepared the work plans and performed the work for Phase I including demolition of the buildings and facilities at the Bannock Street Site and remediation of the vicinity properties. Earth Sciences also developed the remedial design for Phase II and conducted Phase II remedial activities including excavation of most of the soils from the Bannock Street Site, stabilization/solidification (S/S) treatment of the stockpiled soils and placement of treated materials into the monolith. Following Earth Sciences' work at the Site, Shattuck retained Fluor Daniel GTI (FDGTI) to continue the Phase II activities including the remaining excavation, S/S treatment and monolith placement, and construction of the cover system. Harding Lawson Associates (HLA) was retained to perform the groundwater activities. HLA designed and conducted the interim plume monitoring program and the storm sewer remediation. HLA also designed the Phase II groundwater monitoring program and installed the plume and monolith monitoring wells. Qualifications for each of these contractors were submitted to and approved by EPA.

This report is divided into the following sections which describe the remedial activities performed at OU VIII in accordance with the requirements of the UAO relating to the Construction Completion Report:

- Project Delivery Strategy
- Work Performed and QA/AC Activities
- Construction Specifications
- Schedule of Operations

- As-Built Drawings
- Pre-Certification Inspection
- Engineers' Certification
- Shattuck Certification

III. PROJECT DELIVERY STRATEGY

III.A. Project Deliverables

The UAO requires Shattuck to generate work plans and other documents for prior approval by EPA.[1] The work plans to be submitted pursuant to the UAO include the following:

- Phase I – Buildings and Facilities Work Plan
- Phase I – Sampling and Analysis Plan
- Phase I – ACM/Radiological Surveys
- Phase I – Quality Assurance Project Plan
- Phase I – Construction Quality Assurance Project Plan
- Phase I – Site Safety Plan[2]
- Phase I – Pre-final Design Report
- Phase I – Final Design Report
- Phase II – Stabilization/Solidification Work Plan
- Phase II – Sampling and Analysis Plan
- Phase II – Quality Assurance Project Plan
- Phase II – Site Safety Plan[3]
- Treatability Study Work Plan
- Phase II – Construction Quality Assurance Project Plan
- Phase II – Preliminary Design Report (30%)
- Phase II – Intermediate Design Report (60%)
- Phase II – Pre-final Design Report (90%)
- Phase II – Final Design Report (100%)
- Operations and Maintenance Plan
- Monolith Monitoring Plan
- Plume Monitoring Plan

[1] Section IX, Paragraph 25 and Section XIV, Paragraph 40 of the UAO; and Section 4.2.1 of the Statement of Work attached to the UAO.
[2] EPA does not approve or disapprove the Site Safety Plan.
[3] EPA does not approve or disapprove the Site Safety Plan.

Shattuck submitted work plans which correspond to those identified above (the Phase I Design was replaced with work plans for individual tasks) as well as numerous additional work plans for specific remedial activities. Table 1 is a complete list of the work plans and reports submitted by Shattuck. The table identifies for each work plan the dates of submittal, agency comments, Shattuck's response to comments, modifications (if any), final submittal and final agency approval. Table 1 also identifies additional submittals made to EPA pursuant to the UAO including notice of contractors, contractor qualifications, and notice of off-site disposal facilities.

III.B. Project Management

In accordance with Section IX, Paragraph 79 of the UAO, Shattuck's qualified Project Manager, as approved by EPA, was Mr. Robert H. Oliver. Shattuck also had on-site representatives present throughout the remediation activities.

The management team for Earth Sciences included a Senior Project Manager, a Construction Manager, a Field Superintendent, a Health and Safety Manager, a Quality Control Manager and administrative staff. On-site construction activities were performed by AWS Remediation. Off-site support for the design and construction activities included design engineers, construction engineers and accounting and administrative staff as needed. The Project Manager had overall responsibility for the execution of Earth Sciences' scope of work and for coordinating the construction effort with AWS Remediation's management and staff. The pugmill was operated by AWS Remediation's construction team. Joe Cesare & Associates (JCA) served as the QA/QC Manager for Earth Sciences' activities during the construction phase of the remedial action. JCA's activities as QA/QC Manager are discussed in detail in Section IV.B.10. of this report.

The on-site management team for FDGTI included a Project Manager, a Project Controls Engineer, a Construction Manager, a Field Superintendent, a Health and Safety Manager, a Quality Control Manager and an Administrative Assistant. These positions evolved as necessary as the project progressed. Off-site advisors to the team included FDGTI Health Physicists, groundwater geologists, and construction engineers. The Project Manager had overall responsibility for execution of FDGTI's scope of work. The pugmill was operated by a subcontractor, Biochem Technologies, Inc., who coordinated activities through the Construction Manager. Mr. Ben Lo of Aguirre Engineers served as the QA/QC Manager for FDGTI's activities during the construction phase of the remedial action. Mr. Lo's activities as QA/QC Manager are discussed in detail in Section IV.B.18. of this report.

Laborers and operators were supplied by local companies, including R&R International, Inc., Aguirre Engineers, Inc., Onsite Environmental Staffing, Nova Consulting Services and TRS Staffing Solutions. Their activities were directed by the Field Superintendent in accordance with the scope of work. Each day's activities were planned in accordance with the schedule derived from the Phase II specifications. Progress and Site issues were discussed at regular intervals. A weekly progress meeting was held on-site with the contractor, regulatory agencies, the agencies' oversight representative and owner's representatives in attendance.

HLA's remediation activities were managed by a project team that included a Project Manager, Project Engineer, Project Hydrogeologist, Health and Safety Manager and field technicians. All work performed by HLA was supervised by the Project Engineer with oversight by the Project Manager.

HLA subcontracted with Layne-Christensen Company of Denver, Colorado (Layne) for the well installation activities and with Insituform Technologies, Inc. (Insituform) for the sewer remediation. Layne and Insituform technicians were supervised by the HLA Project Engineer.

The engineering drawings for the storm sewer remediation were prepared by HLA's Denver-based Remedial Design Center. The design was reviewed by the HLA Construction Division to ensure constructability. The HLA Construction Division also oversaw the storm sewer remediation field activities. The Denver-based Construction Division is a licensed general engineering contractor with hazardous substance removal and remedial action certification.

All employees for both Phase I and Phase II activities completed the 40 hour HAZWOPER training and were kept current in their annual refresher courses. All employees participated in medical surveillance as outlined in the Health and Safety Plan for the Site.

EPA also had its oversight representative, Morrison-Knudsen (MK), on-site during the primary Phase II activities including excavation and earthmoving activities, S/S processing and placement, and construction of the cover system.

IV. WORK PERFORMED AND QA/QC ACTIVITIES

IV. A. Phase I

Phase I of the remediation involved the demolition of the existing buildings and facilities at the Bannock Street Site. Work Plans were developed for each of the buildings and for the major tasks such as removal of underground storage tanks and utilities and demolition of the stack (see Table 1). In addition, Phase I included the remediation of the railroad right-of-way and the vicinity properties. The specific activities performed during Phase I from mobilization through completion of the vicinity property remediation are described below in greater detail.

IV.A.1. Mobilization

Mobilization activities began at the Bannock Street Site in September 1992. At that time, radioactivity surveys of the buildings and facilities were performed in preparation for Phase I demolition and removal activities. Office trailers and personnel decontamination facilities were mobilized at the Bannock Street Site as specified in the Phase I Mobilization Plan dated September 1992.

IV.A.2. Buildings and Facilities

The buildings and facilities at the Bannock Street Site were demolished during the period of 1992 through 1994. Structures, tanks, paved areas, and manufacturing components were removed from the Site in accordance with the Phase I Buildings and Facilities Work Plan dated January 1993. This work involved the following operations:

- Surface radiation surveys of buildings and facilities
- Salvage of manufacturing equipment
- Demolition of buildings and facilities
- Off-site disposal of noncrushable materials

Each of these activities is further described in the following sections. Figure 3 shows the Bannock Street Site prior to the demolition of the buildings and facilities.

IV.A.2.a. Surface Radiation Surveys of Buildings and Facilities

Buildings and facilities were surveyed for the presence of surficial radioactivity in excess of the following release criteria as set forth in NRC Guideline 1.86:

- Average total radioactivity not to exceed 100 disintegrations per minute per 100 square centimeters (dpm/100cm^2) alpha particle activity;

- Average removable radioactivity not to exceed 20 dpm/100cm^2 alpha particle activity; and

- Maximum total radioactivity not to exceed 300 dpm/100cm^2 alpha particle activity providing that the average criterion over an area of 1 square meter is achieved.

To the extent possible, buildings, facilities, equipment, and appurtenances were surveyed prior to demolition or dismantling. Some items, such as exterior pipe runs, the stack, and storage tanks, were surveyed after demolition or dismantling.

Comprehensive reports of survey activities were submitted to EPA on a building-by-building basis. (See Table 1)

IV.A.2.b. Salvage of Manufacturing Equipment

Certain items of processing equipment, tools, and materials were sold to other businesses for recycling or reuse. All items to be removed from the Bannock Street Site were surveyed to ensure that they achieved the NRC Guideline 1.86 release criteria for unrestricted use identified above. Any items that did not achieve the release criteria were decontaminated and resurveyed to ensure that no materials left the Site for reuse that did not meet the release criteria. Written documentation of the radioactivity survey for each shipment of material sent off-site for recycling or reuse was submitted to EPA. (See Table 1)

IV.A.2.c. Demolition of Buildings and Facilities

Buildings and facilities were demolished using conventional techniques except for the tanks, Building Nos. 3 and 4, and the stack.

Tanks were demolished by cutting them into rectangular sections from the top of the tank to the bottom. Cutting was performed using saws, torches, or other effective means. This controlled demolition was performed in order to produce tank sections that were suitable for radioactivity surveys for off-site disposal.

Building 3 was the former radium production facility, and much of the building material was contaminated with radium in excess of the release criteria. Building 3 was constructed with transite panels placed over a wood frame. The transite was not suitable for incorporation into the monolith because of its asbestos content. The radium concentration precluded disposal of the transite as conventional asbestos containing waste. Consequently, the building was dissassembled panel by panel, with the panels and wooden frame members subsequently packaged in B-25 disposal boxes which were welded shut. The B-25 boxes were sent off-site for disposal at the U.S. Ecology low-level radioactive waste disposal facility located in Beatty, Nevada (the Beatty facility) prior to closure of the facility on December 31, 1992. The Beatty facility was approved by EPA for off-site disposal in accordance with Section XVII, Paragraph 53 of the UAO.

Portions of Building 4, where some uranium processing was performed, were contaminated. Based upon the surveys, selected portions of Building 4 were removed in a controlled manner and packaged for off-site disposal at the Beatty facility. After the contaminated sections of the building were removed, the rest of the structure was demolished using conventional means.

During demolition activities, crushable materials such as slabs, brick, masonry, tile, and glass that would be incorporated into the monolith were segregated from other materials that would require off-site disposal.

IV.A.2.c.1. Stack Demolition

The stack demolition was performed on November 7, 1993 in accordance with the Stack Removal Activities Work Plan submitted to EPA on August 20, 1993 and approved on September 15, 1993. Controlled Demolition, Inc. (CDI), a company specializing in the demolition of outmoded structures through the application of explosives, was retained to perform the demolition.

A radioactivity survey was performed on the lower 20 feet of the stack. The results of the survey showed that the stack materials did not exhibit radioactivity above the radium-226 release standard. Ten bulk samples were obtained from the stack and were analyzed for asbestos content. According to 5 CCR 1001-10 (Regulation No. 8), asbestos-containing material (ACM) is defined as material with a concentration of asbestos which is greater than 1 percent. In all cases, the asbestos content in the bulk samples was less than or equal to 1 percent. Analysis indicated that a thin paint layer on the interior and exterior surfaces of the stack contained 5 percent chrysotile asbestos which was nonfriable.

Despite the results of the asbestos sampling, CDPHE's Air Pollution Control Division raised a concern regarding the potential for release of airborne asbestos during demolition of the stack. Because the stack had already been prepared for demolition and was in a weakened state, and because the test results demonstrated that the stack did not contain ACM, EPA approved the stack demolition as scheduled. Pursuant to the Work Plan, precautionary measures, including extensive water spraying prior to, during and subsequent to the felling of the stack, were taken to prevent generation of airborne materials. Results of air monitoring performed during the demolition confirm that there was no release of airborne asbestos above the applicable standards.

The felled stack was dismantled for off-site disposal at the Conservation Services, Inc. disposal facility in Bennett, Colorado (CSI). CSI was approved for off-site disposal by EPA in accordance with Section XVII, Paragraph 53 of the UAO. A rubberized surface sealant and adhesive (Elasto Seal) was applied to the areas of the stack where the hoe ram would be used. In addition, a water mist was applied to minimize any dust generated during hoe-ramming operations and plastic sheeting was placed on the ground surface around the stack. The results of air monitoring performed in accordance with the procedures set forth by CDPHE in a letter dated May 25, 1994, show that there was no release of airborne asbestos as a result of the dismantling of the stack and no exposure to asbestos to the public or to employees involved in those activities.

IV.A.2.d. Off-Site Disposal of Noncrushable Materials

Noncrushable materials that were not suitable for incorporation into the monolith consisted of the following:

- Wood, paper, roofing material;
- Steel and other metals;
- Asphalt;
- Trash, including used personal protective equipment;
- Miscellaneous debris;
- Transite;
- Portions of Building 4;
- Tools and equipment; and
- Insulation materials, both asbestiform and non-asbestiform.

These materials were disposed of at EPA approved off-site locations or sold to other users. As stated above, transite, components of Building 4, and the wood frame members of Building 3 were packaged in B-25 disposal boxes and transported to the Beatty facility. Other noncrushable materials were loaded into sea vans and disposed of at CSI. Seventy-two sea vans of non-crushable materials, including building demolition debris, were disposed at CSI. The sea vans were surveyed for radioactivity before being sent off-site to confirm that the NRC Guideline 1.86 release criteria were met.

IV.A.3. Vicinity Properties

The vicinity properties were remediated during 1993 and 1994. The vicinity properties included the following sites:

- Dade/Pugliese properties located at 1788 South Acoma Street/1772 South Acoma Street
- Sachs Lawlor property located at 1808 South Bannock Street
- Danielson Construction Company property located at 1860 South Bannock Street
- Centennial Air Conditioning and Heating Co. property located at 1822 South Bannock Street
- Flanagan Ready Mix Ltd. Property located at 1700 South Bannock Street
- Kroonenberg Lumber property located at 1896 South Bannock Street
- Bannock Street shoulder along the Bannock Street Site
- 1800 Block of South Bannock Street
- Railroad Right-of-Way west of the Bannock Street Site.

Remediation of the vicinity properties included the following activities:

- Radiation surveys to confirm the boundaries of the affected material;
- Removal of contaminated soil;
- Sampling and analysis to confirm removal of the contaminated soil; and
- Restoration of the property configuration.

A work plan was prepared for each vicinity property, and approved by EPA prior to implementation. (See Table 1 for a listing of the separate work plans for the vicinity properties.) A Construction Quality Assurance Plan (CQAP) applicable to work at all of the vicinity properties was submitted to and approved by EPA. In accordance with Section XIX, Paragraph 58 of the UAO, access to each property was obtained from the owner before work commenced.

After remediation was complete, EPA performed a construction completion inspection of each of the vicinity properties. Following EPA's inspection, a Construction Completion Report was submitted to EPA for each of the vicinity properties (See Table 1). Soils removed from the vicinity properties were stockpiled on the Bannock Street Site for processing and incorporation into the monolith. The volume of soil removed from each vicinity property is shown on Table 2.

Remediation of the Danielson Construction Company property at 1860 South Bannock Street involved the demolition of the existing structure. At the owner's request, this structure was not replaced upon restoration of the property configuration. The owner was reimbursed for the building by Shattuck at a mutually agreed upon price. Substantial landscaping improvements were performed at the Dade property located at 1788 South Acoma Street.

IV.A.4. Suspension of Phase II Activities

On September 2, 1993, EPA issued an amendment to the UAO which suspended Phase II activities while EPA reviewed the selected remedy. The amendment to the UAO delayed the submittal of the Prefinal and Final Design, thereby delaying the Phase II construction activities. On February 16, 1994, EPA issued a Second Amendment to the UAO which reaffirmed the selection of the on-site stabilization and solidification remedy and ordered Shattuck to resume the Phase II activities.

IV.B. Phase II

Phase II of the remediation involved excavation of the soils from the Bannock Street Site, treatment of those soils along with the soils from the Phase I remediation with a mixture of cement and flyash, incorporation of the treated materials into a monolith and capping of the monolith. Phase II activities also included remediation of the storm sewer and construction of monolith and plume monitoring wells. Details of the implementation of the Phase II activities are described below.

The Final Remedial Design for the monolith was submitted to EPA on June 10, 1996.[4] The design included specifications for excavation, stabilization and solidification processing, preparation of the monolith foundation and placement and compaction of the treated materials. The remedial design also included specifications for the monolith cover system.

The cover system of the monolith incorporates various layers of natural materials designed to meet several key objectives. These objectives are outlined as follows:

- Minimize to the extent practicable the contact of percolating or standing water with the monolith;
- Minimize the contact of water with the monolith by removal of water as surface runoff prior to infiltration through the use of low-permeability barriers over the monolith;
- Minimize surface erosion;
- Minimize differential settlement and subsidence of the cover;
- Provide resistance to damage as a result of root penetration and burrowing animals;
- Provide resistance to freeze-thaw conditions.

The cover system will also provide radon protection and gamma attenuation, although the cover is not necessary to achieve these ARARs.

IV.B.1. Treatability Study

A treatability study was conducted to demonstrate that the soil on the Bannock Street Site would achieve the required performance standards specified in the ROD. The treatability study was performed using full-scale equipment for mixing the selected soils with the stabilization and solidification reagents, i.e. cement and flyash. The treatability study confirmed that results comparable to the prior bench-scale tests performed in

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[4] The submittal of the Final Remedial Design was delayed due to the issuance of the Cease and Desist Order by the City and County of Denver on May 11, 1994, which is discussed in further detail in Section IV.B.7.

connection with the evaluation of the remedial alternatives could be achieved on an operational scale using commercially available equipment and practical construction methods. More specifically, the results of the treatability study confirmed that the proposed treatment method, on-site treatment by stabilization and solidification, would achieve the required performance standards in terms of mechanical strength of the treated material, chemical immobilization of site contaminants and control of radon emanation rates. The treatability study demonstrated that incorporation of the soils into an on-site monolith would be protective of both human health and the environment.

The results of the treatability study are summarized in detail in the Pilot Scale Treatability Study Report and its addenda. (See Table 1)

IV.B.2. Site Management Activities

Site management was provided during the remedial activities. Site management included control of work, access to the Site, and monitoring the work in accordance with plan requirements. The following specific activities were included in the Site management:

Covers: The AAL soil stockpiles were covered with geotextile tarping. The covers were removed from the stockpile each morning only at the working face, i.e., that area from which AAL soils were excavated for processing. The feedstock piles were re-covered with tarping at the end of each work day. From time to time the tarping would be blown off in certain areas due to high winds or storms. In response to requests from EPA and CDPHE, additional work practices and methods were implemented to ensure coverage of the stockpiles to the maximum extent possible.

Stormwater: The Site was graded so that stormwater drained into the temporary construction storage ponds at the north end of the Site. In addition, the Site perimeter fence was lined with silt fencing and bermed with soil to prevent runoff from the Site. Following excavation and backfill of the two storage ponds used during the construction of the monolith, the stormwater runoff was diverted to a subsurface drainage system beneath the perimeter roads

Flagging: Flagging was used as an additional control measure in several areas. Caution tape was placed at the edges of the stockpiles of unprocessed AAL soils. Flagging also was used to demarcate the stormwater retention ponds and other excavations. As operations or stockpiles changed configuration or were moved, re-flagging was performed to ensure the appropriate demarcation of the various control areas. EPA and CDPHE continually reviewed the flagging of the control areas to ensure that the control areas were being appropriately designated.

Fencing: The perimeter fence was maintained throughout construction and any damage was promptly repaired to maintain integrity of the fence.

Dust Control Measures: As stated above, AAL soil stockpiles were covered with geotextile tarping. Covers were employed to minimize windborne migration of these soils. During work activities, these stockpiles were uncovered at the working face as necessary to access the material for processing, and then re-covered at the conclusion of work on a daily basis.

Water trucks were used at the Site on a daily basis to moisten haul roads to minimize dust generation. The water trucks were also used as necessary to dampen soils prior to screening, crushing and transporting. Water spray bars were employed to minimize dust generation. The bars were installed on the crusher discharge outlet conveyor above the reagent storage vessels and along the perimeter fence line.

A number of measures were implemented to control dust from the pugmill and surrounding areas. An enclosure was constructed of timber framing and plastic sheeting to totally enclose the pugmill. This approach proved to be unsatisfactory since the enclosure structure retained heat generated by the operation of the pugmill as well as the dust generated by those operations. The enclosue resulted in unacceptable wear and heat-induced mechanical failure and therefore was abandoned.

Additional water for dust control was provided to the pugmill operating area. Sprinkler towers were erected over the cement and flyash storage structures. The towers were operated whenever cement or flyash was loaded into the storage containers. During normal production activities, this meant almost constant operation of the sprinkler towers.

A water curtain was erected along the west side of the pugmill production area. The water curtain was operated during active production of S/S materials. Additional sprinklers were installed along the eastern fence of the Site adjacent to South Bannock Street. The sprinklers were operated whenever atmospheric conditions favored the production and dispersion of airborne dust from the Site.

A fixed hose was located in the pugmill production and loadout area. A person was assigned to watch for dust generation and hose down any areas within reach of the hose that were generating dust. Other areas were handled by use of water trucks. A person was also assigned to watch the flyash loading area for dust. Delivery vehicles, storage structures and connecting hoses were examined for leaks and delivery of cement or flyash was halted if dust generation was observed. Placement areas were also visually monitored for dust generation. A water truck was used to control dust generation from the placement areas.

Security: On-site security was provided by Shattuck on a seven-day per week, 24-hour a day basis. Employees, vendors and visitors were required to sign in and out. Non-employees were required to be accompanied by a Site escort. The security guards were stationed in a small trailer at the north gate, and were required to walk the Site perimeter every hour. Security personnel did not enter the exclusion zone.

Signage: Warning signs were posted on the perimeter fence and within the construction area and were maintained throughout the construction, with additional signage being added as necessary.

Radiological Instrumentation: Radiological instruments were used during Site activities for a variety of purposes including the measurement of employee exposure to ionizing radiation, measurements of removable activity from surfaces, determination of airborne radioactivity, excavation control, contamination control and measurement of radium activity in soils and other solid materials. The following radiological instrumentation was used at the Site:

- Geiger counters;
- alpha scintillation detectors;
- alpha/beta counters;
- dose rate meters;
- gamma scintillation detectors;
- OCS gamma spectrometer

Additional detail on the radiological instrumentation is set forth in Appendix A.

IV.B.3. Ground Control

In order to accurately track the Phase II excavation, foundation preparation, S/S processing and placement activities, a system of ground control was implemented at the Site. Ground control activities during Phase II operations included the following:

- Determination of ground surface elevations by aerial mapping;
- Establishment of benchmarks;
- Establishment of site-wide grid system;
- Determination of the excavated volumes;
- Determination of fill volumes;
- Determination of foundation elevations;
- Determination of S/S placement volumes;
- Determination of top of monolith elevation.

A Site grid system was established for identifying the location of Site activities. The grid system consisted of a 30 foot by 30 foot area identified by a row (R) and column (C) number (see Figure 4). Rows run from east to west across the Site. Columns run from north to south across the Site. R1C1 was established as the southwest corner of the Site. Each grid was subdivided into 9 blocks of 10-foot square areas. Blocks were numbered 1 through 9, starting with block 1 in the northwest corner of the grid area (see Figure 6).

Temporary survey benchmarks were installed around the perimeter of the Site. The locations of benchmarks were selected by Earth Sciences. The benchmarks were surveyed by Arrow Engineering and Surveying of Denver, Colorado and referenced to the nearest U.S. Geological Survey benchmark.

The temporary benchmarks established control points for volumetric surveys during Site operations. Measurements of excavation volume of AAL soil, BAL soil, and placement of S/S material were maintained on a daily basis.

IV.B.4. Rubble Crushing

Crushing operations began in 1994 during and following building demolition required as part of the Phase I activities at the Bannock Street Site. Concrete building slabs, oversize rocks, brick, block and other masonry material were to be incorporated into the monolith (as demonstrated in the treatability study). In order to process these materials by stabilization and solidification, it was necessary to reduce the material in size so that it could be run through the mixing machinery. Crushing was performed in conformance with the Rubble Crushing Plan dated January 13, 1993. Crushable material was passed through a jaw crusher rendering the material -2 inches in size. Any materials greater than 2 inches that passed through the crusher were screened and reprocessed.

During Phase I, a hoe ram was used in some cases for breaking building slab foundations and for demolishing the stack after it was imploded. During Phase II processing activities, additional rubble crushing was performed to incorporate the crushed rubble stockpile into the monolith. For material that was too large for the jaw crusher but too small to warrant bringing a hoe ram back on-site, a gel-like material called Bristar was used to break-up the concrete. A hole was drilled in the center of the concrete and the Bristar gel was placed in the hole. When the gel dried, it expanded causing the concrete to crack and allowing it to be broken into smaller pieces.

Metal components and organic constituents such as wood, linoleum, and tarpaper were not classified as crushable material. The noncrushable materials were separated, segregated, scanned for radioactivity and disposed off-site at CSI.

IV.B.5. Phase II Mobilization

Phase II mobilization was performed from May 1994 through September 1994 in accordance with the Phase II Mobilization Plan submitted to EPA on March 3, 1994 and approved on May 6, 1994.

The Phase II mobilization activities included excavation and backfill of Rows 21 through 29 on the north end of the Site prior to relocating the support facilities to that area; excavation of Rows 1 through 3 on the south end of the Site to prepare for monolith construction; and construction of the support facilities. A detailed description of each of these activities follows.

IV.B.5.a. Excavation and Backfill of Rows 21 through 29

Rows 21 through 29 in the northern portion of the Site were excavated during the period June 20, 1994 to July 27, 1994. The area was excavated for both above action level (AAL) and below action level (BAL) soils. AAL soils are soils or other earth materials that contain any constituent of concern in excess of the concentration or activity level specified in Table 9-2 of the ROD (Appendix B). BAL soils are soils or other earth materials that do not contain any constituent of concern in excess of those specified concentrations or activities. AAL soil was removed by a backhoe. Radiological instrumentation was used to provide excavation control. The AAL soil was stockpiled for incorporation into the monolith.

BAL soils were also removed from Rows 21 through 29. The former retention basin was previously backfilled with clay and covered with asphalt pursuant to a RCRA Consent Decree between Shattuck and the State of Colorado dated July 11, 1984. The clay was excavated and stockpiled along the west side of the Site for use in the cover system following completion of the monolith construction. Some of the asphalt had been broken up and ultimately disintegrated during building and facility demolition and disposal operations. The remaining asphalt was recovered prior to excavation, segregated, and disposed off-site at CSI with the other non-crushable demolition debris.

Non-clay BAL soils were excavated from Rows 21 througn 29 to approximately the level of groundwater to remove soils with elevated concentrations of molybdenum.

IV.B.5.b. Excavation of Rows 1 through 3

Excavation of Rows 1 through 3 occurred from June 20, 1994 to June 30, 1994. AAL soil was removed by a backhoe. Radiological instrumentation was used to provide excavation control.

BAL soil was removed from this excavation to the approximate elevation of the monolith foundation. The base of the excavation was leveled but not compacted. Due to the shutdown of operations discussed below in Section IV.B.7., the excavated area of Rows 1 through 3 remained open from June 1994 until S/S processing commenced in July 1996.

IV.B.5.c. Support Facility Construction

Following AAL and BAL excavation activities, Rows 21 through 29 were backfilled with roadbase and Class A gravel to approximate original ground level. Two sediment control ponds located side by side and occupying most of Rows 23 through 25 were constructed for erosion control. The southern embankment of the ponds extended to Row 22.

Utility connections were installed in this area. Electricity and water utility connections were established to support office and decontamination trailers relocated to the north end of the property as part of the Phase II mobilization.

IV.B.6. Storage Stockpile Construction

Stockpiling was required to stage the on-site materials for S/S processing. Storage stockpiles were originally constructed in 1994. Separate storage stockpiles were constructed for the storage of AAL soil, clay, and crushed rubble.

AAL soils from the vicinity properties, Rows 1 through 3, and Rows 21 through 29 were combined into one storage stockpile. This stockpile was placed on the west central portion of the Site from approximately Row 9 through Row 20. Upon completion of construction, the stockpile contained approximately 8,200 LCY of AAL soil from the vicinity properties and 14,700 LCY of AAL soil excavated from the Bannock Street Site during mobilization activities.

Clay from the closed impoundment was excavated and placed in two storage stockpiles. One stockpile was located along the western boundary of the Site where the former railroad spur served the Site. The other storage stockpile was located on the east side of the Site. The clay stockpiles contained approximately 3,000 cubic yards of material.

One additional storage stockpile consisted of crushed building debris. The buildings, slabs, pavement, and other crushable material produced approximately 4,000 cubic yards of crushed rubble. The stockpile was constructed on the east side of the Site north of the clay stockpile.

The storage stockpiles were covered to facilitate dust control during the time when operations at the Site were shutdown as discussed below in Section IV.B.7. The stockpiles were covered with heat-welded panels of geotextile. The geotextile was anchored with earth and rock at the base of the storage stockpiles. The stockpile covers were maintained during the shutdown period and replaced as necessary to control dust from the stockpiles.

IV.B.7. Shutdown Period Operations

Shattuck received a Cease and Desist Order from the City and County of Denver on May 11, 1994 alleging that the remediation was being performed in violation of Denver's zoning ordinances. The Order was effective June 11, 1994. Shattuck filed an appeal of the Order on June 10, 1994. Pending the appeal, Shattuck continued work that was not subject to the Order until such work was completed in late September 1994.

The United States filed an action in federal court against the City and County of Denver on August 29, 1994 seeking to overturn the Cease and Desist Order. On February 22, 1996, Judge Wiley Daniel declared Denver's Order to be unlawful. Denver appealed the decision. On May 3, 1996, Judge Daniel denied a motion to stay his decision pending appeal to the Tenth Circuit, and the remedial activities were resumed. On November 10, 1996, the Tenth Circuit upheld Judge Daniel's February 22, 1996 decision. As a result of Denver's Cease and Desist Order, remediation was delayed from October 1994 to June 1996.

IV.B.8. Remobilization

Following the decision that the Cease and Desist Order was unlawful, production equipment was mobilized to the Site in June 1996 and construction of Site facilities necessary for remediation activities was performed. The facilities included two concrete pads: one for equipment decontamination and the other for placement of the pugmill. Initial work activities included preparing feedstock material for treatment by S/S.

IV.B.9. Excavation of Soils, Foundation Preparation, S/S Processing and Placement

Integrated processing and placement of S/S materials began on July 1, 1996. The following operations were conducted simultaneously from July 1, 1996 through November 13, 1997:

- Excavation of AAL soils;
- Excavation of BAL soils;
- Foundation preparation;

- Preparation of S/S feedstock piles;
- Production of S/S materials; and
- Placement and compaction of S/S materials.

These activities are described in the following sections.

IV.B.9.a. Excavation of Soils (Rows 4 through 20)

AAL soils were excavated from the remaining undisturbed portions of the Bannock Street Site extending from Row 4 through Row 20. AAL soils were identified using field radiation monitoring instruments and previous soil sampling and analysis records.

AAL soils were excavated using backhoes and placed in trucks, front end loaders or other suitable equipment for transport to a storage stockpile. AAL soil was transferred directly from the excavation to the storage stockpile when practicable. Space constraints prevented haul trucks from accessing the storage stockpile in some areas. In these cases, AAL soil was transferred from the excavation site to the storage stockpile using front end loaders or bulldozers.

The storage stockpile for the active excavation was located along the center of the Site between the crushed rubble stockpile and the AAL storage stockpile containing soils from Rows 1 through 3 and Rows 21 through 29 (which were excavated during Phase II mobilization as described above), and the vicinity properties. During later stages of excavation, an additional storage stockpile was located at the south end of the Site on the completed monolith.

Ground crews equipped with radiation monitors worked in conjunction with excavator operators to separate AAL soils from BAL soils. Periodic samples of soils to be excavated were sampled and analyzed on site for Bismuth-214 by OCS in accordance with the procedure described in the Field Activities Procedures Manual (FAPM). The FAPM was prepared for EPA by ChemNuclear Geotech to guide cleanup of uranium mill tailings sites.[5] Excavation continued until sample results indicated less than 15 pCi/g of radium-226 above the background level of 1.5 pCi/g as determined in the Final Remedial Investigation Report for the Denver Radium Site, Operable Unit VIII, prepared by Versar Inc. for EPA, dated January 1991. Volumes of AAL soil removed were reported to Shattuck and EPA's on-site representative on a daily basis.

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[5] The OCS actually determines the concentration of Bismuth-214 which is used as a surrogate for Radium-226. ChemNuclear Geotech derived an empirical conversion factor using linear regression techniques to relate measured Bismuth-214 to Radium-226 in soil. EPA approved this technique for use at the Bannock Street Site.

The majority of the BAL soils were left in place, leveled and compacted to create the monolith foundation. However, any soil remaining between the base of the AAL soil excavation and the foundation grade was removed as BAL soil. Control measures were taken to keep AAL and BAL soils segregated, including creating separate stockpiles and using designated equipment (or equipment which was decontaminated prior to handling BAL soils) to handle each stockpile to eliminate the possibility of cross contamination. Space restrictions during construction resulted in some BAL soils being temporarily placed on areas shown by laboratory testing to have all AAL soil removed.

Due to space restrictions, some BAL soils also were placed temporarily on top of the monolith. A liner was placed on the monolith prior to the placement of these soils. The BAL soils were removed by a front end loader with the final 3 to 4 inches of soil being removed by hand shoveling to ensure that the surface of the monolith was not damaged.

A total volume of 43,214 BCY (51,857 LCY using the ratio of 1.2 LCY per BCY) of AAL soil were excavated from the Bannock Street Site. This volume includes the AAL soil excavated from Rows 1 through 3 and Rows 21 through 29 during mobilization activities and the soil excavated from Rows 4 through 20 during the Phase II activities. Adding in the soil from the vicinity properties and the crushed rubble, the total volume of soil and rubble to be incorporated into the monolith was approximately 54,213 BCY (63,256 LCY).

IV.B.9.a.1. Soil Excavation QA/QC Activities

A Quality Assurance Project Plan (QAPP) and a Construction Quality Assurance Plan (CQAP) for Phase II operations were prepared in accordance with the UAO. The QAPP was originally submitted for review by EPA on October 15, 1992 and was approved on March 31, 1993. The CQAP was submitted on May 9, 1994 and approved on October 3, 1994.

Soil excavation quality assurance/quality control involved the following operations:

- Excavation control during excavation activities to separate AAL soil from BAL soil;
- Field verification sampling of the limit of excavation;
- Laboratory confirmation of the limit of excavation.

These activities are described in detail in the following sections.

IV.B.9.a.1.A. Excavation Control

Excavation control activities determined field segregation of AAL soils and BAL soils. AAL soils were stockpiled for S/S processing and BAL soils were stockpiled for on-site construction activities.

Instrumental monitoring was provided on a continual basis during excavation activities. Measurements were recorded when a change in soil color, texture, or consistency was observed or at the discretion of the excavation control technicians. A description of the instrumentation used can be found in Appendix A.

Radiological surveys were performed utilizing a shielded gamma scintillometer and an OCS. The shielded gamma scintillometer was used during excavation of AAL soil to determine the level of gamma radiation at the excavated ground surface and to guide excavation and segregation of radioactive soils for S/S treatment. The average gamma readings were measured and recorded. When the gamma scintillometer readings were acceptable for each grid, verification samples were collected.

IV.B.9.a.1.B. Field Verification of Excavation Limits

Verification samples consisted of a composite of soil samples collected from the center and corner blocks of the grid. A composite soil sample of approximately 500 grams was placed in a metal can, sealed, and taken to the on-site laboratory for measurement of the radium-226 concentration using the OCS. If the OCS verification analyses showed that the radium-226 concentration was less than 15 pCi/g above background, excavation was considered complete and laboratory confirmation samples were collected. Results of OCS testing were submitted to Shattuck and to EPA's on-site representative each day and are summarized in Table 3.

One of the action levels set forth in Table 9-2 of the ROD, was thorium-230. Thorium-230 is the radiological precursor of radium-226. (Radioactive decay of thorium-230 by alpha particle emission produces radium-226.) Thorium-230 is not in itself detectable using field instrumentation or the OCS spectrometer. Neither is it detectable with more sophisticated laboratory instruments utilizing gamma spectrometry. As directed by EPA, in order to verify that excavation to remove radium-226 contamination below the activity specified in Table 9-2 of the ROD would also result in the removal of thorium-230 to a level below the action level, the first 20 grids excavated from the southern portion of the Site during the Phase II mobilization activities were submitted for laboratory analysis of thorium-230 by alpha spectrometry. (This is the reference method for determination of thorium-230.) The results of these initial 20 grids showed that excavation control methods for removal of radium-226 to activities below the action level also resulted in the removal of thorium-230 to activities below the action level.

IV.B.9.a.1.C. Laboratory Confirmation of Limit of Excavation

Confirmation samples were composed of 3 to 10 verification samples composited to form a soil sample. The composite samples were submitted to Acculabs Research, Inc. in Golden, Colorado (Acculabs) for analysis of radionuclide content and arsenic, selenium and lead. Figures 5 and 5a show the location of the excavation confirmation composite samples for Earth Sciences and FDGTI, respectively.

No activity was performed on an area after sampling until results of the confirmation sampling were reported. Results of the confirmation samples were submitted to Shattuck and EPA's on-site representative and are summarized in Tables 4 (Metals) and 5 (Radionuclides). All samples sent off-site for confirmation testing were returned to the Site for incorporation into the monolith.

IV.B.9.b. Foundation Preparation

After removal of AAL and BAL soils necessary to achieve the design elevation, the foundation was prepared using dozers, loaders, and compactors. The monolith foundation was established at the grades specified in the Final Remedial Design. The base elevations of the monolith foundation are shown on Plate 1.

Several locations within the Site exhibited clay lenses at the foundation grade elevation. In order to produce a sound foundation, the clay lenses were removed and the clay was allowed to dry and was reused for other on-site construction activities. The excavated area was backfilled with BAL soils.

AAL soil extended below the base of the foundation grade in some areas. Those AAL soils were removed and the areas were backfilled with BAL soil to foundation grade unless the excavated area extended into or below the water table. If groundwater was encountered, the depression was backfilled with Class A gravel to the water table. The subbase was backfilled with BAL soil to foundation grade. Where it was necessary to use imported fill, the fill was tested to ensure that it met the requirements for BAL soil. BAL soils and backfill were placed in layers not to exceed 9 inches loose thickness, as set forth in Specification 02200, Part 3.8. The backfill was compacted to 90 percent maximum dry density (ASTM D 1557 Modified Proctor density) in accordance with the Specification 02200, Part 3.7. All other foundation grades requiring no backfill, were proof-rolled and compacted to 90 percent maximum dry density.

In a very limited area of the Site, it was necessary to compact the monolith foundation using a different process than set forth in the specifications. In and around Row 8, a granular subgrade soil was encountered that could not be properly tested using the method referenced in the specifications. After discussion with EPA's oversight contractor in the field, an alternative compaction procedure was used. In accordance with accepted engineering principles, in this limited area, the soils were graded, surveyed and then compacted using a Hypac C-850 vibratory, smooth-drummed roller. Four passes over the soils were made, and the foundation was surveyed. Another pass was made with the roller and then the area was surveyed again. This process was repeated until, after the sixth pass, the Construction Inspector determined that no additional compaction was achieved. Accordingly, the Construction Inspector approved the area for placement of S/S material.

IV.B.9.b.1. Foundation Preparation QA/QC

Imported fill was tested to verify that the concentrations of constituents of concern found in Table 9-2 of the ROD were not exceeded. The compaction of the foundation was tested on a regular basis to verify that the compaction was within the requirements of the design and the RA Work Plan. The foundation compaction test results are shown in Table 6.

IV.B.9.c. Preparation of Feedstock Piles

Individual feedstock piles were prepared for S/S production. Feedstock piles were composed of AAL soil from the storage stockpiles with an admixture of crushed rubble from the crushed rubble stockpile. Both crushed rubble and AAL soil were passed through a power screen to remove oversize material defined as -2 inches and later defined, with approval of EPA, as -3 inches. Oversize material was stockpiled for further crushing.

Each feedstock pile was tested for radiological concentration and engineering properties. The testing included:

- Radium-226 concentration (OCS)
- Optimum density and moisture content (ASTM D 588 with D 1557 compaction energy)
- Moisture content of the feedstock soil (ASTM D 4643)
- Atterberg limits (ASTM D 4318)
- Particle size distribution (ASTM D 422)
- In place density (ASTM D 1556)
- Standard soil classification (USCS)

IV.B.9.c.1. Feedstock Characterization QA/QC

The above testing was performed before a feedstock pile was placed in service. The engineering tests were performed in accordance with ASTM reference standards cited above in Section IV.B.9.c. Soil classification was performed using the Unified Soil Classification System. In-place density was determined by the sand cone method (ASTM

D 1556). Modified Proctor densities and moisture contents were also performed to evaluate the feedstock material (ASTM D 1557 and ASTM D 4643, respectively). In addition, the radionuclide content of each stockpile was measured using the OCS prior to production of S/S material.

Feedstock piles were also sampled periodically during production. Moisture contents were tested at least twice each day to ensure that water addition rates remained appropriate. Radionuclide concentrations were evaluated using OCS twice each day. Results of feedstock characterizations were presented to Shattuck and to EPA's on-site representative and are summarized in Table 7.

IV.B.9.d. Production of S/S Material

Production of the S/S material was accomplished by feeding the screened AAL soils into the pugmill where it was mixed with Type I/II Cement and Class C Flyash at a ratio of 70 to 20 to 10, respectively, by dry weight as demonstrated in the treatability study. Water was added to the above mixture to achieve a target moisture content of 4 to 6 percent above optimum in accordance with the Construction Specifications. Some S/S material proved to be difficult to work with at 4 percent above optimum moisture. When this condition was observed in the field, the QA/QC manager would order the water content to be reduced to approximately 2 percent above optimum or until working properties of the S/S mixture were acceptable for placement. In all cases, moisture content of the S/S material was maintained wet of optimum to provide adequate water for hydration of the cementitious materials.

The daily pugmill production is summarized in Table 8 and includes the volume of the reagents used in the production process. The daily production reports indicate that approximately 99,687 wet tons of soil were processed through the pugmill. Based on an average moisture content for the feedstock piles of 14 percent, the amount of dry soil processed is approximately 87,603 dry tons. Using a dry density of soil of 3,225 lb/yds,[6] the volume of soil processed is approximately 54,330 BCY.

A description of the pugmill calibration procedures is set forth in Appendix B.

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[6] Caterpillar Performance Handbook, Edition 27, 1996 lists the dry density of soil as between 3,200 and 3,250 lb/yd^3.

IV.B.9.d.1. S/S Material Characterization QA/QC

S/S material was sampled for a variety of characteristics as specified in the Remedial Action Work Plan and included the following:

- Unconfined compressive strength at 3 days curing time;
- Unconfined compressive strength at 7 days curing time;
- Unconfined compressive strength at 28 days curing time;
- Extractable radionuclides and metals.

Samples for testing of unconfined compressive strength were obtained at least once each day for every 500 cubic yards of S/S material placed in the monolith. Cured cores were tested for extractable radionuclides and metals at a rate of one test for every 10 days of S/S processing. Moisture content of the S/S material was also measured periodically each day to verify that the moisture content was within –2/+4 percent of optimum after placement of S/S.

Moisture content and unconfined compressive strength were determined on the Site. Cores were prepared using standard proctor compaction and allowed to cure in a moisture and temperature controlled environment for the stipulated amount of time (where the results of the 7 day tests were acceptable, the 28 day tests were not performed). The unconfined compressive strength was determined according to the ASTM test method. Extractable radionuclides and metals were determined on a solid core section by Acculabs.

Test results of unconfined compressive strength were provided to Shattuck and EPA's on-site representative and are summarized in Table 9. The leachability test results are summarized in Table 10.

IV.B.9.e. Placement and Compaction of S/S Material

S/S material was trucked to the area of the monolith being constructed. S/S material was placed using a dozer and compacted using a smooth drum vibratory compactor in lifts with a maximum thickness of 12 inches. Throughout the placement of S/S processed materials, the lift thickness was monitored to ensure that a lift thickness of 12 inches was not exceeded. As discussed below, when the use of metal forms was implemented to obtain a better edge on the lifts, the forms were fabricated to a height of 12 inches to maintain a lift thickness of 12 inches or less. Processed material was compacted within 45 minutes of mixing. The material was compacted to at least 90 percent of the Modified Proctor density (ASTM D 1557).

In accordance with Section 02215, Part 3.4 of the Specifications, at the end of construction activities each day, exposed S/S processed materials were moistened and covered with plastic to maintain a moist surface. If more than 5 hours elapsed before placement of overlying or adjacent S/S mixture, a cold joint was considered to have occurred. In accordance with Section 02215, Part 3.3 of the Specifications, cold joints between lifts of processed materials were treated with dry portland cement (which was moistened) to develop a sound bond between lifts.

To produce a sharp edge on the individual lifts that also exhibited the required compaction and strength required the consideration of several methods. The first method considered was to trim the edge of the lift using a bobcat or small loader bucket. This technique worked acceptably with regard to achieving a well compacted lift edge. However, the amount of reject material produced was unacceptable.

Other techniques were considered including the use of walk-behind vibratory rollers and equipment-mounted plate compactors. In addition, a variance permitting tapered edges of the lifts was sought and obtained from EPA. However, these alternative techniques were not able to produce an edge that provided the required degree of compaction in the amount of time necessary to keep up with an acceptable production rate for S/S material.

Two additional techniques were considered which involved using forms to help hold the edge while the material was compacted. Wooden forms were tried and rejected as not strong enough to confine the lift edge while compaction was taking place. Finally, steel forms were tried and were found to be acceptable. Earth Sciences utilized steel forms to confine the edge material and walk-behind "jumping jack" vibratory compactors to provide edge compaction. FDGTI also utilized steel forms to confine the edge material, but utilized vibrating plate compactors to provide the compaction energy to the edge of the lift.

IV.B.9.e.1. Compaction of S/S Material QA/QC

After S/S material compaction, the degree of compaction was tested using the ASTM method for sand cone density (ATSM D 1556). Density was measured at least once per day of production, and at least once every 500 cubic yards of production. The location of each compaction test and source feedstock was recorded. Results of each compaction test were provided to Shattuck and the EPA's on-site representative and are summarized in Table 11.

For compaction tests that indicated less than the required 90 percent of maximum Modified Proctor density, the test area was mechanically recompacted and retested. If the retest did not achieve 90 percent compaction, a sample of the compacted material was obtained using a portable coring machine and cured for 28 days. The unconfined compressive strength was measured to verify that the required degree of unconfined compressive strength was at least 50 pounds per square inch. Table 11 indicates those compaction tests which did not meet the 90 percent maximum Modified Proctor density requirement. The footnotes to Table 11 describe the actions that were taken for tests that did not meet the 90 percent maximum Modified Proctor density requirements (see also Section V.B.4. of this report).

IV.B.10. Site QA/QC Manager Activities

Joe Cesare and Associates (JCA) provided full time inspection services for Earth Sciences' activities during the construction phase of the remedial action. The construction inspector provided quality control services for all phases of the construction activity including operation of the geotechnical laboratory, production of the S/S mixture, placement of the S/S mixture, compaction of the S/S mixture, and production of cold joints and other time-dependent parameters.

JCA trained applicable Earth Sciences' personnel in geotechnical testing of soils and S/S materials prior to the start of S/S production. Personnel were trained in laboratory operations and conducting the required tests in accordance with the ASTM procedures.

In addition to training these personnel, JCA provided QA/QC oversight, observed test procedures, and approved test results before acceptance and release of the test data. JCA provided periodic process audits of laboratory operations to ensure conformance with ASTM procedures.

IV.B.11. Demobilization

Earth Sciences and AWS Remediation demobilized from the Site during March and April 1997. Equipment was surveyed for surface radioactivity to confirm that it met the NRC Guideline 1.86 release criteria prior to removal from the facility. Trailers, other support facilities, and equipment for maintaining the perimeter air monitoring system remained on-site.

Some waste materials were left on-site following Earth Sciences' demobilization. These materials were characterized and removed for disposal by Envirochem, Inc. during 1997 and 1998.

IV.B.12. Mobilization of FDGTI

Following Earth Sciences work at the Site, FDGTI continued the Phase II remediation activities. FDGTI mobilized to the Site in April 1997. As part of the mobilization activites, a feed hopper fitted with grizzly, pugmill and two feed silos (for cement and fly ash) and screening plant were brought on to the Bannock Street Site by FDGTI's subcontractor, Bio-Chem Technologies of Riverside, California. Two 6,000 ton storage units (pigs) were already on site for storage of cement and fly ash. Heavy equipment, water trucks and light equipment also were mobilized to the Site, as required to perform the work. A mobile crusher was mobilized to handle crushing of oversize rubble as necessary. The former decon trailer was replaced with a suitable structure and the Soils Lab was retrofitted. FDGTI utilized the existing on-site contractor office trailers.

IV.B.13. Preparation of Monolith Foundation from Rows 18 through 24

Rows 18 through 21 of the monolith foundation were prepared by FDGTI in accordance with the design and in the same fashion as Rows 1 through 17. As the excavation, S/S treatment, and construction of the monolith proceeded, it became necessary to extend the monolith foundation to accommodate additional processed material as approved by EPA. Rows 22 through 24 were added to the monolith foundation to the north. As with previous foundation preparation activities, AAL soils were excavated for S/S treatment and replaced with stockpiled BAL soil and imported fill to bring the foundation up to grade.

IV.B.14. Processing and Placement of all Remaining AAL Soil

Additional volume of processed material over the monolith design necessitated adding three and one-half 12-inch lifts to the top of the monolith, as well as extending the monolith to the north. Modifications to the monolith design made it necessary to also modify the cover design. Instead of using 18 inches of clay on top of the monolith, EPA approved the use of a geosynthetic clay liner with a 6-inch layer of clay as bedding for the liner. The modifications to the monolith and cover design are further described in Section V.B. of this report.

IV.B.15. Shutdown Period Operations

During construction of the monolith cover, additional slope stability analyses were required to address the change in materials for the cover system. Construction operations were suspended while the analysis was performed from December 12, 1997 through February 19, 1998.

IV.B.16. Completion of the Monolith

The construction equipment was remobilized on February 20, 1998, and construction activities resumed on the same day. All S/S processing was completed by November 13, 1997. The top elevations of the completed monolith are shown on Plate 2.

Following completion of the monolith construction, the monolith was surveyed by Arrow Engineering & Surveying. Based on the survey, the monolith volume was calculated. The average surveyed volume of the monolith is 83,610 yd^3.

The volume of the monolith can be used to calculate the volume of soil that was incorporated into the monolith. Using the monolith volume of 83,610 yd^3 and an average dry density of the monolith of 115.9 lb/ft^3 (Table 11), the dry weight of the monolith is 130,820 tons. Subtracting the weight of the cement and flyash of 28,586 and 14,509 tons (Table 8), respectively, the dry weight of the soil in the monolith is 87,725 tons. Using a dry density of soil of 3,225 lb/yd^3 (as cited above in Section IV.B.9.d.), the volume of soil in the monolith is approximately 54,406 BCY (65,287 LCY). This is very close to the volume of soil and crushed rubble determined to be incorporated into the monolith through surveying of the stockpiles as discussed above in Section IV.B.9.a. and through calculating the volume of soil processed through the pugmill as discussed in Section IV.B.9.d.

IV.B.17. Monolith Cover Completion

In order to meet the objectives of the cover system which are described above in Section IV.B., the monolith cover is designed and constructed with a geosynthetic clay liner (ClayMax) overlying a 6-inch clay layer on top of the monolith and 18 inches of clay on the sideslopes. The cover system includes a 12-inch filter drainage layer of sand and gravel to assist in transporting surface water from the top of the monolith, and an 18-inch layer of riprap to provide long-term durability, resistance to burrowing animals and erosion protection. Overall, the combined layers of the cover system also provide resistance to freeze-thaw conditions, and provide for radon protection and gamma attenuation.

The cover system materials were tested for conformance with the Construction Specifications. Table 12 is a summary of the cover clay physical properties test results. Figure 11 displays the results of the moisture-density and permeability testing of samples of the clay materials used to construct the clay cover. The test results presented on Table 12 and Figure 11 were obtained from samples of clay material from the western end of an approximately 40,000 cubic yard stockpile at the Bluestone Aggregate Company facility in Jefferson County, Colorado (see Figure 12). Approximately 13,000 yards of clay material were obtained from this facility and used as clay cover or bedding material for the geosynthetic clay liner (ClayMax). The original remedial design anticipated in situ permeability testing of the clay cover after placement and compaction of the clay at the Shattuck Site. It was determined that such testing would not only significantly delay and prolong construction activities, but that such testing would require the clay cover material to remain exposed to the elements for several months while the tests were being performed. Such exposure was contradictory to the requirement that the clay cover be covered with sand as soon as possible after placement and compaction. Consequently, a revised procedure was developed whereby the permeability of the clay material was determined for a given range of molding water contents and densities. Figure 11 presents the results of these tests in a graphical form. Based on these test results and restricting the allowable moisture content to –1 to +4% of optimum, the acceptable density values that resulted in a permeability value of 1 x 10^{-7} cm/sec or less for these moisture contents were determined. The acceptable moisture contents were used to control the moisture and density during placement and compaction of the clay cover materials so as to achieve the required permeability specification.

Table 13 summarizes the results of the gravel and riprap physical properties tests and rock quality scores. In addition, the clay layer was tested to confirm that it was adequately compacted in accordance with the Construction Specifications. The field compaction tests for the clay cover are summarized in Tables 14 and 14a. A summary of the cover materials placed is shown in Table 15.

Construction of the monolith cover was completed in accordance with the approved design on May 21, 1998. Plate 3 shows the top of the clay layer. Plate 4 shows the top of the sand layer and Plate 5 shows the top of the gravel layer. Plate 6 shows the surveyed top of the riprap material to provide final topographic elevations for the completed monolith cover system. A cross section of the cover system which shows all of the individual layers is shown in Plate 7. Plate 7a shows additional detail of the toe drains on the sideslopes and the north end.

Upon completion of the cover system, radiation surveys were conducted in accordance with Section 01420, Part 3.8 of the Construction Specifications. The surveys included gamma and radon flux surveys on top of the cover system and radon concentration testing along the perimeter of the Site. Plates 8, 9 and 10 show the locations of the gamma, radon flux and perimeter radon tests, respectively. The results of the surveys were submitted to EPA on September 24, 1998.

The gamma survey was conducted using the Row, Column grid system in accordance with Section 01420, Part 3.8A of the Specifications. A measurement using a microR meter was taken for every 100 square meters. The average measurement above background at one meter above the surface was 1 uR/hr. Table 16 shows the results of the gamma survey of the cover system. The values are substantially below the 20 uR/hr standard provided in Table 9-2 of the ROD.

The radon flux measurements were taken at a frequency of 1 per 20,000 square feet in accordance with Section 01420, Part 3.8B of the Specifications and in accordance with procedures approved by EPA and CDPHE. Table 17 shows the radon flux measurements for the cover system. The mean radon flux, including background, was 0.06 pCi/m2-s. The ARAR provided in Table 9-2 of the ROD is 23.7 pCi/m2-s.

The radon concentrations at the Site property line were measured by placing charcoal canisters on the property-line fence at a frequency of 1 per 100 linear feet in accordance with Section 01420, Part 3.8C of the Specifications. Measurements were taken for a period of 48 hours as specified by EPA and CDPHE. Table 18 shows the Site perimeter radon sampling results. The average radon concentration, including background, measured along the property-line fence was 0.3 pCi/l (rounded up from 0.28 pCi/l). The radon concentration standard, including background, provided in Table 9-2 of the ROD is 0.65 pCi/l.

IV.B.18. QA/QC Activities

FDGTI implemented the Phase II QAPP and CQAP developed by Earth Sciences without any changes. FDGTI had a full-time QA/QC Manager on-site at all times. Daily QA/QC reports were completed and submitted by the QA/QC Manager.

IV.B.18.a. Site QA/QC Manager Activities

Mr. Ben Lo served as the QA/QC Manager and was on-site at all times during construction activities. Mr. Lo is a registered Professional Engineer in Colorado, and holds an M.S. in Geotechnical Engineering and a Ph.D. in Engineering. The QA/QC Manager was responsible for supervising the soils technicians and the air quality technician, and for managing subcontracted work such as surveying, off-site testing, and slope stability analyses. The QA/QC Manager reviewed and sealed all appropriate drawings and documented required specifications revisions. He also reviewed field operations to ensure compliance with work plans and specifications.

The QA/QC Manager was on-site full-time throughout construction. In addition to regular interface with the on-site EPA representative, inspections of the following construction activities were made on a continuing basis:

- Pugmill calibration and production operation
- Screening operation for feedstock material
- Crushing operation for rubble
- Placement and compaction of monolith
- Geotechnical laboratory testing operation
- In-place sand cone density testing
- Foundation excavation operation and control
- Placement and compaction of backfill material
- Placement and compaction of RSCL
- Placement of GCL (Geosynthetic Clay Liner)
- Placement and compaction of filter drainage layers (sand & gravel)
- Placement of rip-rap material
- Placement and compaction of common fill at the north slope
- Decontamination of on-site transportation routes and equipment surfaces
- Seeding on the north slope
- Surveying activities

In addition, the QA/QC Manager reviewed all test results and reports prior to submission.

The QA/QC Manager provided the following training for the geotechnical personnel:

- Preparation and handling of soil cement
- Sampling procedures for materials addressing in the SAP
- Field analytical techniques
- Soil mechanical properties and testing
- Documentation of sampling and field analytical procedures
- Use of standard forms for CQA activities
- Knowledge of the construction specifications

The QA/QC Manager routinely reviewed the procedures used for tests performed in the laboratory. He also provided oversight to the laboratory technicians to insure that the tests were performed as required.

IV.B.19. Perimeter Air Monitoring

Perimeter air monitoring was performed during Phase II operations in accordance with the Phase II Air Monitoring Plan as revised by the Phase II Mobilization Plan. Before earth-disturbing Phase II operations commenced, modifications to the air monitoring program were implemented. The changes included the addition of PM_{10} samplers and relocation of some of the sampling stations. Figure 6 shows the location of the air monitoring stations. Perimeter air monitoring measured the following characteristics on a daily basis:

- Total suspended particulates (TSP)
- Total suspended particulates equal to or less than 10 microns in diameter (PM_{10})
- Total long-lived airborne alpha emitting radionuclides considered as thorium-230

During construction activities, the concentration of airborne metals, arsenic, selenium and lead were measured each week and if there was an exceedance in TSP or PM-10 for a particular monitoring station.

The air monitoring system remained in place and the approved Air Monitoring Plan was implemented until the completion of stabilization of AAL soils and placement of all processed materials. The air monitoring activities including descriptions of the meteorological station, TSP samplers and PM_{10} samplers, are discussed in detail in

Appendix D to this report. The results of the perimeter air monitoring, which were included in the Monthly Status Reports submitted to EPA, are presented on Appendix N.

Despite considerable efforts to control dust generation from the stockpiles and the processing operations at the Site as described above in Section IV.B.2., EPA issued five Notices of Violation (NOV) for exceedances of air standards for TSP and PM-10. In response to receipt of an NOV, efforts to keep dust generation to a minimum were intensified in order to prevent future exceedances.

The dust minimization efforts focused heavily on controlling dust from the pugmill and surrounding area. After an enclosure constructed for the pugmill proved to be unworkable, additional water was provided to the pugmill operating area. This included installation of sprinkler towers over the cement and flyash storage structures and the addition of a water curtain along the west side of the pugmill production area. The sprinkler towers and water curtain were operated during any active production of S/S materials. Sprinklers were also installed along the eastern fence of the Site adjacent South Bannock Street. These sprinklers were operated when conditions favorable to dust generation and dispersal of airborne dust existed. Hoses and water trucks were also used extensively to minimize dust generation

There were no exceedances in the airborne radionuclide standards. Although the radionuclides are reported as 24-hour measurements, the airborne release criteria for radionuclides are annualized averages. If all of the 24-hour filters had been analyzed, the average values for radionuclides would have been even lower than presented in Appendix N.

IV.B.19.a. Inspection and Audit by CDPHE

CDPHE inspected the documentation of the perimeter air monitoring system shortly after the beginning of the construction period. A field flow calibration was performed using CDPHE's calibration testing equipment. The calibration verification was within the expected flow rate.

CDPHE also performed an audit of the perimeter air monitoring system during the Phase II construction activities. The CDPHE audit and Earth Sciences' response indicated that air quality results obtained from the perimeter air quality monitoring system were valid.

IV.B.20. Health and Safety Instrumentation

Earth Sciences/AWS Remediation used the following types of instruments and detectors in addition to the radiological instrumentation previously identified:

- Personal sampling pump;
- Airborne dust monitor; and
- Ammonia detector.

The health and safety instrumentation was used to evaluate the potential exposure of employees to potentially hazardous airborne contamination.

FDGTI also used the following health and safety instrumentation at the Site:

- Mini-Ram dust monitor, Model PDM-3
- Hnu photoionization detector, with a 10.2 eV probe
- SKC personal sampling pumps and media
- Gilibrator flow calibrator
- Quest sound level meter
- Combustible gas meter

Detailed descriptions of the health and safety instrumentation are set forth in Appendix E.

IV.B.21. Debris Disposal and Equipment Decontamination

Debris consisted of tarps, plastic, PPE, straw, scrap metal, scrap wood, the former Soils Lab and other materials described above. All material met criteria to be disposed of at CSI. Fifty sea vans and 4 roll-offs were utilized to contain, transport and dispose of Site debris. All useful equipment and supplies removed from the Site were decontaminated and scanned prior to release from the Site. Decontamination consisted of removal of all dirt and dust with a pressure washer and hand tools, followed by a scrub and additional pressure wash.

IV.B.22. Excavation and Disposal of Oil-Impacted Soils

The RI noted an area of soils contaminated with petroleum hydrocarbons (oil-impacted soils) on the southern portion of the Site. During the excavation of AAL soils in the area of Rows 7 and 8, a small volume (approximately 3 to 4 yards) of oil-impacted soils were encountered. In accordance with Section 2 of the approved Remedial Design, an evaluation was conducted to determine if these soils could be treated with the other AAL soils and placed in the monolith.

Testing cylinders were made of the oil-impacted soils and leachability and strength tests were conducted in accordance with EPA and CDPHE approved procedures. The cylinders passed all leachability and strength criteria and, accordingly, the materials were treated and incorporated into the monolith. The results of the leachability and strength testing are set forth in Appendix F.

During foundation preparation, oil-impacted soils were encountered within the footprint of the monolith and north and west of the placed monolith in Row 17. On January 31, 1997, Shattuck submitted to EPA a plan to determine the extent of oil-impacted soils in the western portion of Row 17, a proposal for bioremediation of any oil-impacted soils in this area, and a procedure for addressing oil-impacted soils during foundation preparation for Rows 18 through 21.

In order to determine the extent of oil-impacted soils, 5 auger holes were drilled through the top of the monolith along Row 17 until underlying soil was encountered. One soil sample was taken from each auger hole from visibly stained soil above the water table. Samples were submitted to an approved laboratory for analysis.

Results from the analyses showed that all of the total petroleum hydrocarbon (TPH) concentrations from the samples were below 500 parts per million with the exception of a single sample in the westernmost portion of the monolith which exhibited slightly elevated levels of TPH. Upon receipt of the results, EPA approved the construction of a trench on the northern and western edges of the monolith and the plan to implement active aerobic bioremediation in the boreholes and along the trench.

The trench was constructed along the northern and western edges of the monolith in Row 17. The trench ran 35 feet in a north-south direction and 125 feet in an east-west direction. It was constructed at a depth about one foot below the water table and a width of about 2 feet. The east-west portion of the trench averaged 4 to 5 feet in depth and the north-south section averaged 10 to 12 feet in depth. Soil samples also were collected from the trenches and submitted for analysis.

Using the soil analytical data from the borings and along the northern edge of the monolith, calculations were derived to support the quantity of Oxygen Release Compound (ORC) introduced into the subsurface in the borings and the trenches for the bioremediation program. The ORC is designed to release dissolved oxygen into groundwater thereby making oxygen available for biodegradation of hydrocarbons that may be present in the soil. The approved bioremediation program involved placing a mixture of ORC and water into the boreholes and placing a calculated amount of ORC powder in the trench. After the ORC was placed in the borings, the boreholes were grouted with cement.

Following the bioremediation activities, approximately 2,000 cubic yards of oil-impacted soils encountered during foundation preparation in Rows 18 through 21were excavated, stockpiled and disposed off-site at CSI.

Additionally, a bioremediation system, as approved by EPA and CDPHE, was installed along an approximate 120-foot length of the western boundary of the Site in the vicinity of Rows 17 through 20. The bioremediation system consisted of 24 vertical air injection wells for the introduction of oxygen into the shallow soils and underlying groundwater. The introduction of oxygen will stimulate natural bioremediation processes to remove hydrocarbons that may be beneath the western perimeter of the Site. Also, five soil vapor monitoring points were installed to allow for respiration testing to measure the oxygen and carbon dioxide content in the soils. Baseline respiration tests were conducted prior to activating the system. Plate 12 shows the location of the bioremediation system.

It is anticipated that the bioremediation system will be operated for a period of six months. At the end of six months, respiration tests will be conducted to determine if biological activity, and, therefore, bioremediation in continuing to occur.

Additionally, monolith monitoring well DSE-4 will be sampled and analyzed for diesel range total petroleum hydrocarbons (TPH). Dissolved oxygen in DSE-4 will be measured in the field. All data will be evaluated by EPA to determine if the bioremediation system should continue.

IV.B.23. Interim Plume Monitoring

In July 1994, HLA conducted the Interim Plume Monitoring Program (IPMP) in the vicinity of the Site. The work consisted of installing and developing four monitoring wells, redeveloping two existing monitoring wells, installing a staff gauge in a pond north of the Overland Park Golf Course, surveying, water level monitoring, groundwater sampling, and chemical analysis. The purpose of the IPMP was to obtain additional geologic, piezometric, and groundwater quality data northwest of the Site. The data obtained were used to assess the extent of the South Santa Fe Drive storm sewer in contact with affected groundwater. The results of the IPMP were presented in the Interim Plume Monitoring Program Report submitted to EPA on February 2, 1995. The data presented in the IPMP report were used to develop a remediation plan for the affected portion of the South Santa Fe Drive storm sewer.

IV.B.24. Storm Sewer Remediation

A Sewer Remediation Plan, which was submitted to EPA on May 9, 1995 and approved on August 8, 1995, was prepared as part of remedial activities for the South Sante Fe Drive storm sewer located west of the Site. The Sewer Remediation Plan presented the design basis for storm sewer remediation, including a description of the storm sewer system, identification of storm sewer portions requiring remediation, development of design criteria, technical approach, construction support activities, estimate of construction costs, and a construction schedule. Revisions to the Sewer Remediation Plan were made at Denver's request. Sewer remediation was conducted by HLA and its subcontractor Insituform Technologies, Inc. in February and March 1997, and consisted of cleaning, lining, sealing, and testing a portion of the storm sewer system. A Construction Completion Report for sewer remediation, dated June 10, 1997, was prepared to document the construction methodology and activities used for the remediation project. Figure 9 shows the storm sewer remediation construction.

IV.B.25. Well Installation and Development

Well installation and development was performed for the monolith and plume monitoring programs. The monolith monitoring program will evaluate the continued effectiveness of the stabilization and solidification of the contaminated soils. The plume monitoring program will evaluate the attenuation and flushing of affected groundwater downgradient of the Bannock Street Site after implementation of the stabilization and solidification remedy.

Well installation and development was performed between June 3 and June 10, 1998 in accordance with approved project work plans. Ten monolith monitoring wells (USE-1 through USE-5, DSE-1 through DSE-5) and one plume monitoring well (APM-1) were installed. Plate 11 shows the locations of the monolith monitoring wells. Figure 10 shows the locations of the plume monitoring wells. The monitoring wells were developed between June 10 and June 12, 1998, in accordance with the procedures set forth in Addendum Number 1 to the Phase II SAP. Wells DSE-1 and DSE-2 were dry at the time development was conducted. Purged water produced during well development was containerized in labeled, DOT-approved, open top 55-gallon drums. Filled drums were sealed and temporarily stored on-site. The water was composited in a tank and sampled for laboratory analyses. The water was then disposed at CSI. Details of the well installation and development, including the boring logs, are provided in Appendix G.

IV.B.25.a. Well Installation and Development QA/QC

Prior to drilling, a preconstruction meeting was held on-site between HLA personnel, Layne, and the EPA oversight personnel to review the work planned, the applicable requirements for performing the work, and health and safety requirements for performing the work. A daily log was maintained for the drilling activities. The daily log included the date, pertinent weather information, a list of equipment used on the project, and work completed. Boring logs were maintained for each hole drilled, as well as well construction forms and monitoring well development forms. In addition, the drillers also documented daily activities in a separate daily log.

The Project Manager, or designated representative, was in contact with field personnel on a daily basis, and routinely performed QC checks on drilling activities. No corrective actions were required during drilling activities. The QC checks included the following items:

- Review of daily logs;
- Review of boring logs and total drilling depths;
- Review of well construction details;
- Review of field instrumentation monitoring data; and
- Review of general field operations to evaluate compliance with project work plans.

Original documentation of well construction activities on the Site are maintained in HLA's central file room, and are available for EPA review upon request.

IV.B.25.a.1. Field Instrumentation QA/QC

Equipment used during field activities was examined to certify that it was in satisfactory operating condition. Each piece of equipment was calibrated at a frequency specified by owner and operator manuals provided by the manufacturer. The name, model number, and serial number for each piece of equipment were recorded on the field daily logs.

IV.B.26. Stop Work Orders

On August 28, 1996, EPA directed Shattuck to stop work at the Site due to concerns about dust generated from the stockpiles, haul roads and operation of the pugmill. In addition, EPA requested documentation on the compaction of S/S materials that were processed and placed on August 21, 1996 for which the initial results indicated a degree of compaction of less than 90 percent.

In order to address EPA's concerns, Earth Sciences implemented additional measures to control the generation of dust from the stockpiles, haul roads and operation of the pugmill. These measures are discussed in detail above in Section IV.B.2. With regard to the compaction documentation requested by EPA, Earth Sciences submitted additional information which demonstrated that the subject processed material from August 21, 1996 was adequately compacted and met the design objectives of the monolith. Based upon the measures implemented, EPA lifted the stop work order on September 4, 1996.

On January 22, 1997, EPA again stopped work at the Site in order to resolve technical issues regarding monolith placement activities and vertical cracking observed in the surface area of one row of the monolith. In addition, EPA requested additional data on the oil-impacted soils prior to the continuation of S/S processing and placement.

In response to EPA's stop work order, Earth Sciences provided additional documentation on the lift edges of the monolith. The documentation included an independent opinion of Joe Cesare & Associates which concluded that the bonding between the then-existing and new monolith materials would be adequate and that the thermal crack in Row 16, Column 9 would be sealed by future monolith placement. EPA and CDPHE were satisfied with this response.

With respect to the oil-impacted soils, on January 31, 1997 Shattuck submitted to EPA a plan to determine the extent of oil-impacted soils in the western portion of Row 17, a proposal for bioremediation of any oil-impacted soils in this area and a procedure for addressing oil-impacted soils during foundation preparation for Rows 18 through 21. The details of the plan and the work performed pursuant thereto are discussed above in Section IV.B.22. Based on the bioremediation plan, EPA lifted the stop work order on March 20, 1997.

V. CONSTRUCTION SPECIFICATIONS

V.A. Construction Specifications

Final construction specifications for implementation of the remedial action are attached as Appendix H.

V.B. Modifications to Specifications

Descriptions of the EPA approved modifications to the design specifications are set forth below.

V.B.1. Foundation Preparation (Section 02200, Part 3.7)

As described in Section IV.B.9.b. above, a portion of the foundation material in and adjacent to Row 8-9 consisted of a cohesionless sand and gravel alluvial material. The original specifications for evaluating the density of the foundation could not be used for cohesionless materials. An alternate procedure was developed to provide compaction of cohesionless materials. The procedure specification included a minimum of six passes with the vibratory compactor over cohesionless material. The modification of the foundation preparation specification was discussed with EPA's on-site representative in the field and implemented in accordance with accepted engineering principles.

V.B.2. Stabilization/Solidification (Section 02210, Part 2.2B)

Screening of the stockpiled soils was impeded by the high moisture content of these soils. The soils blinded the screen and caused excessive carryover of fine material to the oversize screening. A request was submitted on June 5, 1997 to change the specified 2-inch screen size to a 3-inch screen size opening. The pugmill operator confirmed that the pugmill could safely accept material with a particle size of up to 3 inches. EPA approval was dated June 24, 1997, following submittal of additional documentation.

V.B.3. Placement of S/S Materials (Section 02215, Part 3)

EPA approved use of a sloping edge for lifts of placed and compacted S/S materials (Section 02215, Part 3.1D). In addition, EPA approved the placement and compaction of S/S materials at temperatures above 30° F and expected to rise above 32°F (Section 02215, Part 3.1J). Although the modifications were requested and approved by EPA, implementation of these modifications proved to be unnecessary. After consideration of several different techniques, an alternative method for the outer edge of the compacted S/S layer was implemented. The specifications were revised to allow use of metal plates as forms for the S/S material. The forms were held in place by inserting metal pins into the completed monolith layers. After compaction, the forms and pins were removed when the S/S materials developed sufficient strength so that edge deterioration would not occur (see discussion of edge techniques in Section IV.B.9.e.).

V.B.4. Monolith Placement – Compaction Procedures (Section 02215, Part 3.2)

The construction specifications required compaction of the S/S mixture to 90 percent of the Modified Proctor maximum density. A provision was not included in the original specifications for materials that did not achieve 90 percent of the Modified Proctor maximum density. A few of the compaction tests performed on placed S/S material resulted in less than 90 percent Modified Proctor maximum density. Earth Sciences and the construction inspector proposed additional testing on portions of the placed S/S material that showed less than 90 percent Modified Proctor maximum density but more than 85 percent Modified Proctor maximum density. It was determined that the material could be left in place if EPA's required Unconfined Compressive Strength of 50 pounds per square inch was attainable. Any placed and compacted S/S material that achieved less than 85 percent of the Modified Proctor maximum density was removed and reprocessed (see Table 11 and footnotes to table).

There were 304 cubic yards of processed materials produced on October 24, 1997 between 7:30 and 10:30 am and placed between column number 9.5 and 11, and Row 18 and 22. The ambient temperature during the production period was above 36° F but due to a weather change, the temperature fell to below 32°F immediately after the processed materials were placed. The soil cement was properly compacted prior to termination of operation. A field density test was attempted but was abandoned due to snowfall. At the end of operation, the surface of the newly placed soil cement was covered with plastic sheets. The surface of the monolith placed on October 24, 1997 was visually inspected on October 29, 1997. There was no visual evidence of soft spots, cracking, peeling or pitting which might have been caused by frost. To further verify that the soil cement placed on October 24, 1997 met all design specifications, nine 3-inch diameter core samples were obtained on October 30, 1997. The core samples were visually inspected by both FDGTI and the EPA representative. There was no evidence of freezing or any signs of damage due to frost. Unconfined compressive strength (ASTM C-39) and unit weight of these core samples were determined by Aguirre Engineers, Inc. The test results indicated that the soil cement placed on the monolith on October 24, 1997 met all Construction Specifications. A request for approval of these placed materials together with Aguirre Engineers' report were submitted on November 7, 1997. The request was approved by EPA on November 13, 1997.

V.B.5. Increased Monolith Height and Geosynthetic Clay Liner (Section 02778)

Approval of an additional three 12-inch lifts to be placed on top of the monolith was requested. To minimize the impact of the increased height of the monolith, a geosynthetic clay liner overlying a 6-inch clay layer was proposed for the top of the monolith to replace the 18 inches of compacted clay specified in the design. The request with its supporting documents was submitted to EPA on June 5, 1997. EPA approved the placement of a geosynthetic clay liner with 6 inches of clay on the top of the monolith and 18 inches of clay on the sides of the monolith. In addition, EPA approved the use of ClayMax 200R in lieu of Bentomat DN since the revised design included the geosynthetic clay liner on only the top of the monolith.

V.B.6. Increased Monolith Height at South End

Near the completion of processing, it became apparent that additional AAL soils would not fit as processed material within the approved three additional 12-inch lifts. Approval was sought for one additional 6-inch lift to be placed on top of the monolith at the south end. The request was submitted to EPA on November 5, 1997 and approved on November 13, 1997.

V.B.7. North End Design

To meet slope requirements, the design of the north end of the monolith was modified to address the increased monolith height. The modification involved the extension of the monolith to the north through Rows 22, 23, and 24. The request was submitted to EPA on November 7, 1997 and approved on November 13, 1997. Table 19 shows the compaction results for the below action level material used on the north end of the monolith.

V.B.8. Recompacted Soil/Clay Layer (RSCL) (Section 02271)

The procedures for verifying that the required clay permeability was achieved were changed as part of the final cover design submittal. The testing was revised from in situ field permeability testing of the layer to pre-delivery testing of the material at the borrow source. In situ field testing would have taken several months to perform and would have required leaving all or portions of the clay material exposed until the testing was completed, subjecting the clay cover to drying and desiccation.

As part of the revised procedure, samples of the clay material to be used to construct the cover were compacted to various densities at various moisture contents and subjected to permeability testing. The results of this testing are presented in Figure 11. Based on these data, an acceptable range of moisture content and a minimum dry density values were identified so as to achieve a minimum hydraulic conductivity value of 10^{-7} cm/sec or less. This range of acceptable moisture content and minimum dry density were then used to control the placement and compaction of the clay material during the construction of the recompacted soil clay layer portion of the cover system.

V.B.9. Riprap Testing Methods

The project specification referenced Appendix B of the Final Remedial Design for certain ASTM tests to be performed on the proposed material sources. Because the same source was to be used for both the riprap and gravel, the specification for the riprap referenced gravel test methods, ASTM C131 and ASTM C88. Subsequently, when it was necessary to obtain an alternative riprap source (other than the gravel source) testing was required for riprap only. Accordingly, the riprap testing was done using riprap test methods ASTM C525 and ASTM D5240. The change in test methods was approved by EPA by letter dated March 24, 1998.

V.B.10. Seeding and Mulching (Section 02930)

Due to the unavailability locally of the specified fertilizer, a substitute was approved which is commonly used in the area for similar purposes. Additionally, the specified drill to be used was to be equipped with packer wheels. However, since one could not be located, the use of one with drag chains was approved by EPA.

V.B.11. Installation of Monitoring Wells

In several instances, well locations were moved slightly to account for difficulties encountered during borehole drilling. For example, the first boring for well USE-4 was abandoned due to encountering a boulder at an approximate depth of 11 feet below ground surface. Following approval from EPA and CDPHE, the borehole was abandoned by filling it with bentonite chips, and a new location approximately three feet north was drilled.

VI. SCHEDULE OF OPERATIONS

Figure 13 presents a timeline of the Phase I and Phase II remediation activities.

VII. AS-BUILTS

The following As-Built Drawings are included in this report:

Plate 1	-	Monolith Foundation Elevations (IV.B.9.b.)
Plate 2	-	Top of Monolith Elevations (IV.B.17.)
Plate 3	-	Top of Clay Layer Elevations (IV.B.17.)
Plate 4	-	Top of Sand Elevations (IV.B.17.)
Plate 5	-	Top of Gravel Elevations (IV.B.17.)
Plate 6	-	Top of Riprap Elevations (IV.B.17.)
Plate 7	-	Cross Sections (IV.B.17.)
Plate 7a	–	Cross Section of Cover System – Toe Drains (IV.B.17.)
Plate 11	-	Monolith Monitoring Well Locations (IV.B.25.)
Plate 12	-	Location of Bioremediation System (IV.B.22.)

The as-built drawings for the Top of Monolith Elevations (IV.B.17.)(Plate 2), Top of Clay Layer Elevations (IV.B.17.)(Plate 3), and Top of Riprap Elevations (IV.B.17.)(Plate 6) are based on final surveyed elevations conducted by Arrow Engineering and Surveying (Arrow Engineering) of each individual layer.

The as-built drawing for the Monolith Foundation Elevations (IV.B.9.b.)(Plate 1) is based on final surveyed elevations by Earth Sciences and pre-final surveyed elevations by FDGTI. For Rows 1-17, Arrow Engineering conducted the pre-final surveys and staked the foundation bases for final grading and compaction. The final elevations shown on Plate 1 were surveyed by Earth Sciences. For Rows 18-24, the elevations presented on Plate 1 are the pre-final surveyed elevations. Additional fine grading was performed after the pre-final survey elevations were obtained.

The as-built drawings for Top of Sand Elevations (IV.B.17.)(Plate 4) and Top of Gravel Elevations (IV.B.17.)(Plate 5) are based on final surveyed elevations conducted by Arrow Engineering and verified construction observations based on pre-final surveyed stakes. The final grades and thickness of portions of the sand and gravel layers were established using grade stakes based on pre-final elevation surveys performed by Arrow Engineering. Final elevations of those portions of each layer were checked in the field against the grade stakes. In addition, field survey checks were made of the final grade of each layer by construction supervisors.

Appendix I is the Final Cover System Elevation Report which shows the elevations and measured thicknesses of the individual cover layers.

VIII. PRE-CERTIFICATION INSPECTION

VIII.A. Notice

The Construction Pre-Certification Notice was submitted to EPA on September 17, 1998 and is attached as Appendix J.

VIII.B. Pre-Final Inspection Report/Construction Completion Forms

A Pre-Final Inspection was held at the Site on September 17, 1998 with representatives of EPA and CDPHE. The inspection included a site-walk around the perimeter of the monolith and the perimeter of the Site, and on top of the monolith. A copy of the Pre-Final Inspection Report is attached as Appendix K.

Additional construction activities were performed to address the items identified in the Pre-Final Inspection. Several of the items addressed relate to the bioremediation system. Two damaged air sparge wells were replaced on October 7, 1998; surface grade well protectors were installed over the six soil vapor monitoring probes on October 8, 1998; and an inlet silencer was added to the air sparge blower on November 20, 1998. Also on November 20, approximately 210 tons (120 cubic yards) of ¾ to 1½-inch crushed granite rock was installed on the west, east and north perimeter road, bringing the road grade above the base of the fence up to the grade of the protective covers on the air sparge wells and vapor monitoring probes and around the air sparge blower building and the north entrance to the Site.

Additional vegetation activities were performed on the north slope of the monolith to address bare areas that were identified during the inspection. The activities included tilling, re-seeding, crimping and fertilizing the bare areas. The irrigation system was also examined to ensure proper irrigation of the revegetated area. Approximately one acre of native grasses was re-seeded. The re-seeding operations were completed on December 7 and 8, 1998 by Spahn Landscape in good weather and absent frozen soil.

During the Pre-Final Inspection, damage to the westernmost portion of the southern perimeter fence was identified. The damaged area of the fence is to be repaired by the Regional Transportation District (RTD) when RTD replaces the western site perimeter fence upon completion of RTD's construction on the adjacent property. The observed damage to the fence does not affect the integrity of the fence in limiting trespass on the Site.

The Pre-Final Inspection Report also notes that Shattuck will remove the guard shack and the portable toilet following EPA's approval of this Construction Completion Report. A decision has not yet been made as to when to terminate the guard services. The guard shack and portable toilet are necessary as long as the guard remains on-site.

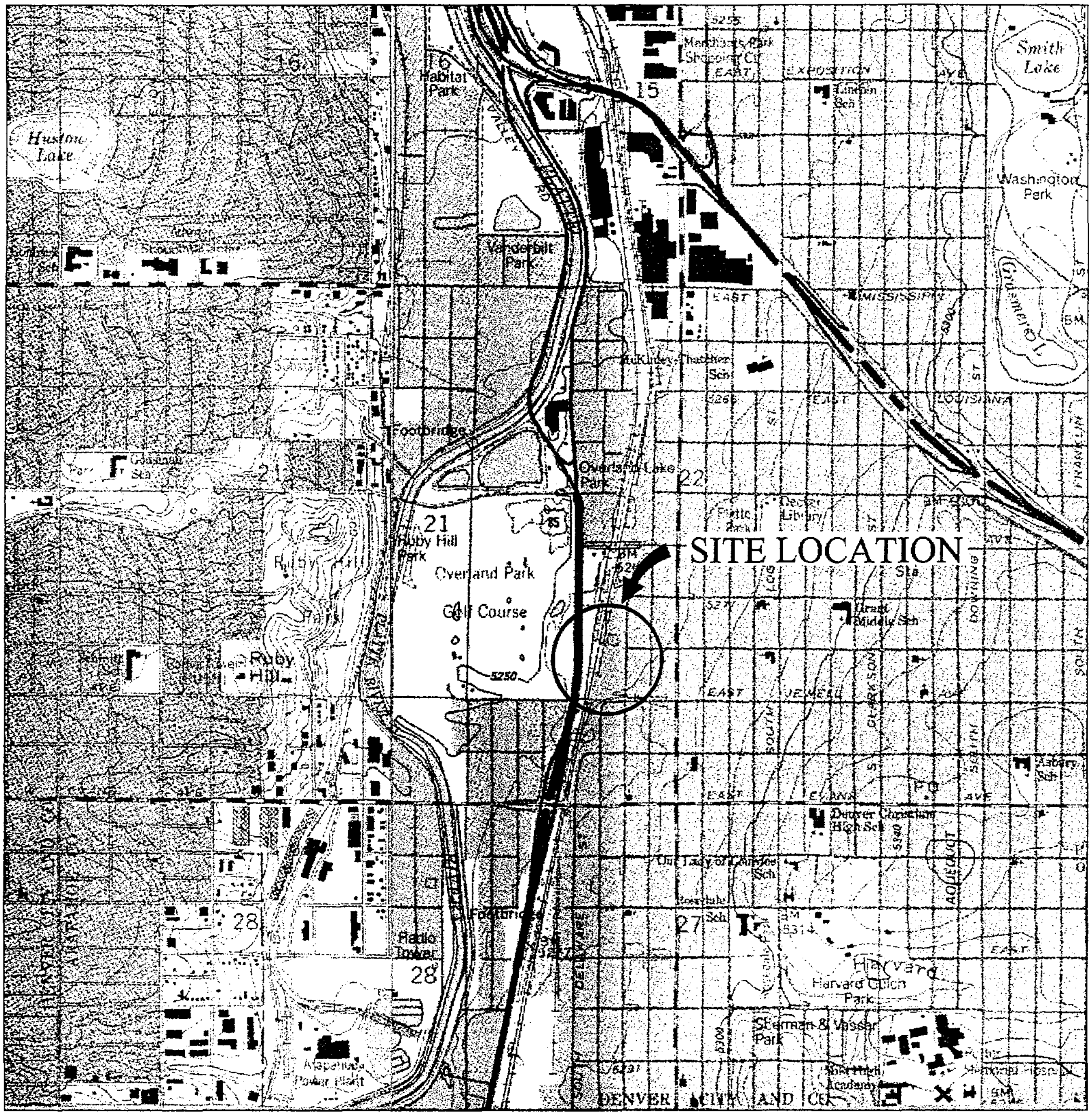
IX. ENGINEERS' CERTIFICATIONS

The certifications by Earth Sciences/AWS Remediation, Fluor Daniel GTI and Harding Lawson Associates are attached as Appendix L.

X. SHATTUCK CERTIFICATION

Shattuck's certification is attached as Appendix M.

Appendix O includes photographs of various activities conducted as a part of the remediation.



SCALE – FEET

0 2000

N

REFERENCES

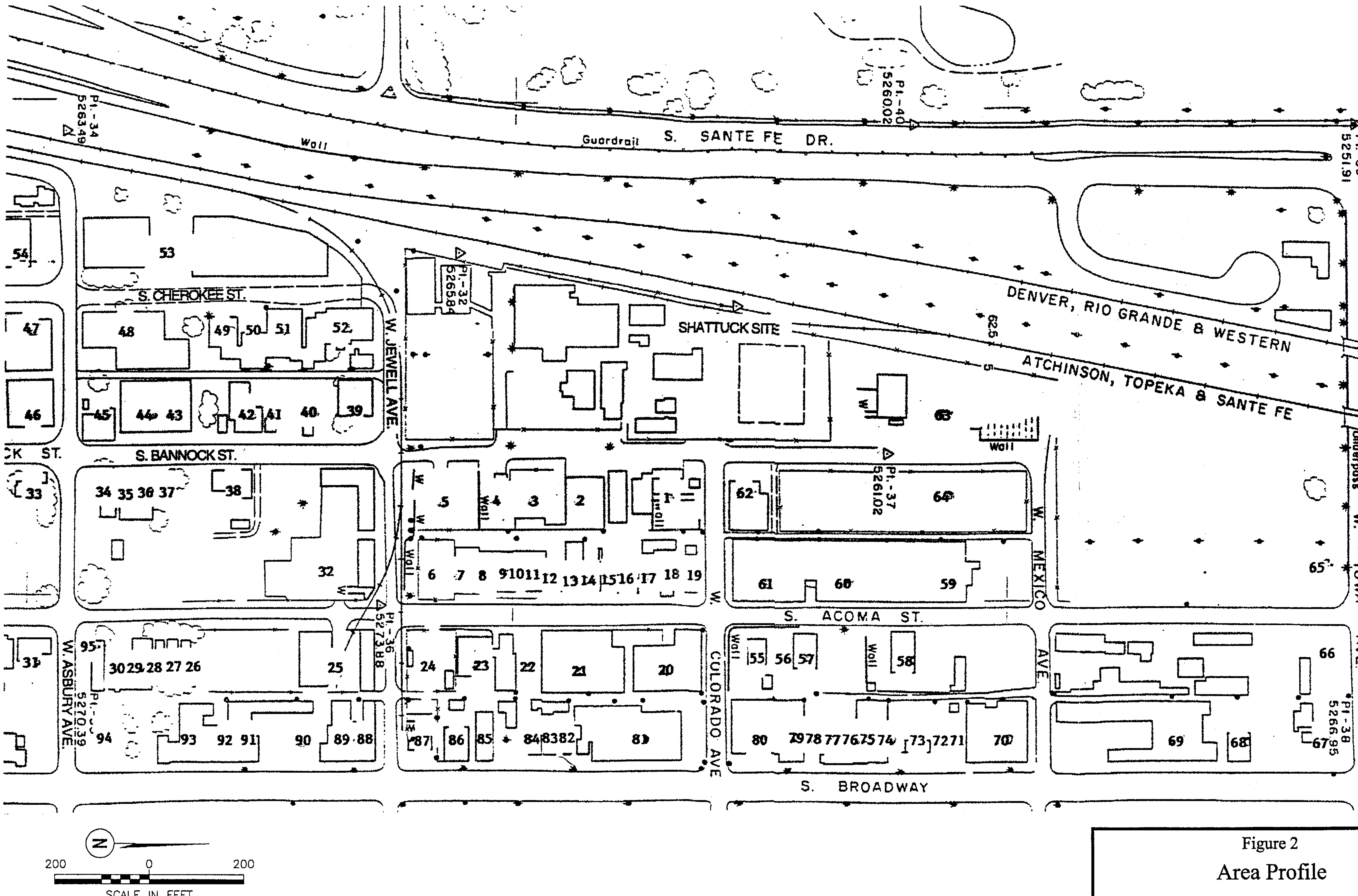
1. USGS 7.5-MIN TOPOGRAPHIC QUADRANGLE, ENGLEWOOD, COLORADO, DATED 1965, PHOTOREVISED 1994, SCALE 1:24000.

2. USGS 7.5-MIN TOPOGRAPHIC QUADRANGLE, FORT LOGAN, COLORADO, DATED 1965, PHOTOREVISED 1980 SCALE 1:24000.

Figure 1

Site Location Map

BAN-27A



BAN-AREA

Figure 2
Area Profile

DENVER RADIUM SITE
OPERABLE UNIT VIII

AREA PROFILE

	Company	Address	Type of Business	Years at this Location
1.	Sachs Lawlor	1808 S. Bannock	Sign painting; garage and repair shop; retail stamps (formerly Gates Energy Products - electrical and battery research)	Over 20 years
2.	Centennial Air Conditioning & Heating	1822 S. Bannock	Repair and service of air conditioners and furnaces	Over 10 years
3.	RJR Circuits	1828 - 1830 S. Bannock	Manufacture of circuit boards and other electronics	Over 10 years
4.	Danielson W O Construction Co.	1860 S. Bannock	Construction company	Over 10 years
5.	Kroonenberg Lumber Company	1896 S. Bannock	Lumber yard and storage	Over 15 years
6.	Electrical Supply	1879 S. Acoma	Formerly Sonig Spark Co. & Klint's Autotop	Not Available
7.	Designer Hardware	1877 S. Acoma	Retail fixtures and hardware	Not Available
8.	Southwest Electric	1875 S. Acoma	Electric repair and service	Over 5 years
9.	Not Available	1865 S. Acoma	Formerly Nationwide Printing Contractors	Not Available
10.	Commercial building	1853 S. Acoma	Not Available	Not Available

11.	J D Davis	1849 S. Acoma	Fire extinguisher recharge and service	Over 5 years
12.	Precision Interiors	1835 S. Acoma	Special woodworking	Not Available
13.	Business - no signage	1833 S. Acoma	Not Available	Not Available
14.	Business - no signage	1831 S. Acoma	Not Available	Not Available
15.	Business - no signage	1827 S. Acoma	Not Available	Not Available
16.	Business - no signage	1825 S. Acoma	Not Available	Not Available
17.	Business - no signage	1819 S. Acoma	Not Available	Not Available
18.	Residence	1811 S. Acoma	Appears to be Private Residence	Not Available
19.	Residence	1805 S. Acoma	Private Residence	Not Available
20.	Doric Manufacturing Company	1800 - 1810 S. Acoma	Machine shop specializing in making gears (formerly a body shop and van conversion shop)	Over 10 years
21.	National Federation of the Blind of Denver	1830 S. Acoma	School for the blind	4 years
22.	American Industrial (Steiner Corporation)	1850 S. Acoma	Industrial laundry and uniform rental; retail paper products	Over 50 years
23.	Electric Supply	1870 S. Acoma	Wholesale electrical supplies distributor	Over 30 years
24.	Kroonenberg Lumber	1800 Block of S. Acoma	Lumber yard and storage	Over 15 years

25.	Kroonenberg Lumber	1900 Block of S. Acoma	Lumber yard and storage	Over 15 years
26.	Residence	1946 S. Acoma	Private Residence	Not Available
27.	Residence	1950 S. Acoma	Private Residence	Not Available
28.	Residence	1952 S. Acoma	Private Residence	Not Available
29.	American Appliance - Parts & Service	1974 S. Acoma	Appliance repair and parts sales	Over 20 years
30.	Residence	1950 S. Acoma	Private Residence	Not Available
31.	Tools Unlimited	2000 S. Acoma	Used tools warehouse	Approx. 8 years
32.	Kroonenberg Lumber	1900 Block of S. Acoma	Lumber yard and storage	Over 15 years
33.	Residence	2000 Block of S. Bannock	Private Residence	Not Available
34.	Colorado Golf Repair	1982 S. Bannock	Golf club repair	Over 25 years
35.	ProBuilt	1976 S. Bannock	Machine Shop	9 months
36.	Front Range Medical Exchange	1972 S. Bannock	Not Available	Not Available
37.	Tam's #1 Auto Wrecking	1960 S. Bannock	Recycled auto parts	Over 10 years
38.	Fred & Sie's Autobody	1940 S. Bannock 1950 S. Bannock	Auto body shop	Since 1960
39.	Nationwide Painting	1900 Block of S. Bannock	Painting Services	Not Available

40.	Communication Resources Inc.	1925 S. Bannock	Cable/television work for TCI	6 months
41.	Piper Sprinkler Company	1935 S. Bannock	Underground sprinkler installation service	8 years
42.	Tam's #1 Auto Wrecking	1937 S. Bannock	Recycled auto parts	Over 10 years
43.	BMW Bavarian Machines	1955 S. Bannock	Automotive repair and bodywork	Over 5 years
44.	General Welding Repair	1965 S. Bannock	Electrical arc welding and repair	Over 20 years
45.	American Budo Judo College	1995 S. Bannock	Martial arts school	Over 40 years
46.	Tico's Mexican Foods Commissary	2011 S. Bannock	Food products service	Over 10 years
47.	Multilift, Inc.	2000 S. Cherokee	Manufacture E Z Lift conveyors	Over 15 years
48.	Scott Tools & Machinery, Inc.	1990 S. Cherokee	Machine tool dealers	Approx. 10 years
49.	ACA Denver Boiler/Air Conditioning Associates, Inc.	1954 S. Cherokee	Heating and air conditioning repair	Approx. 25 years
50.	Pasterkamp Heating & Air Conditioning	1930 S. Cherokee	Heating and air conditioning supply	Over 30 years
51.	Custom Stainless	1920 S. Cherokee	Supplier of custom fabrication for stainless steel kitchens	30 years
52.	Century Graphics	1910 S. Cherokee	Commercial printers	Over 20 years

53.	Custom Window	1955 S. Cherokee	Manufacturer of custom windows	Not Available
54.	Euro Collision Center	330 W. Asbury	Towing	25 years
55.	Residence	1788 S. Acoma	Private Residence	Not Available
56.	Residence	1772 S. Acoma	Private Residence	Not Available
57.	Commercial building - no signage	1770 S. Acoma	Not Available	Not Available
58.	Midwest Frame and Alignment Specialists	1750 S. Acoma	Garage and auto repair shop	Over 10 years
59.	Flanagan Ready-Mix Limited	1705 S. Acoma	Concrete production	Not Available
60.	Sachs Lawlor	1717 S. Acoma	Sign painting; garage and repair shop; retail stamps (formerly Gates Energy Products - electrical and battery research)	20 years
61.	Greif Brothers	1745 S. Acoma	Sell cardboard cylinders and packaging; sales outlet; warehouse	Approx. 10 years
62.	Sachs Lawlor	1790 S. Bannock	Sign printing	Not Available
63.	Flanagan Ready-Mix Limited	1700 S. Bannock	Concrete production	Not Available
64.	Flanagan Ready-Mix Limited	1700 Block of S. Bannock	Concrete production	Not Available
65.	TCI	1617 S. Acoma	Administrative offices (formerly Mile Hi Cable)	Over 5 years
66.	Residence	1610 and 1612 S. Acoma	Private Residence	Not Available

67.	Impala Motors	1601 S Broadway	Used car lot	Over 20 years
68.	Robinson Tile & Linoleum	1645 S. Broadway	Retail	Not Available
69.	Not Available	1649 S. Broadway	Formerly Harris Auto & Parts Co.	Not Available
70.	Dependable Cleaners	1701 S. Broadway	Pick-up, drop-off, warehouse and offices	Over 50 years
71.	Not Available	1725 S. Broadway	Auto sales	Not Available
72.	Not Available	1729 S. Broadway	Formerly Private Residence	Not Available
73.	Not Available	1737 S. Broadway	Not Available	Not Available
74.	Ready Men Labor	1745 S. Broadway	Day labor service	10 years
75.	Ready Men Labor, Inc.	1749 S. Broadway	Temporary labor services (formerly a catering company)	Not Available
76.	Not Available	1755 S. Broadway	Formerly retail store for military items	Not Available
77.	Decorative Art	1761 S. Broadway	Not Available	Not Available
78.	Barber Shop	1765 S. Broadway	Barber Shop	Not Available
79.	The Antiques Trader	1775 S. Broadway	Retail antiques	30 years
80.	The Chairman	1787 S. Broadway	Retail furniture sales (formerly antique store)	Approx. 4 years

81.	American Industrial (Steiner Corporation)	1800 Block of S. Broadway	Industrial laundry and uniform rental; retail paper products	Over 50 years
82.	Residence	1845 S. Broadway	Private Residence	Not Available
83.	Residence	1849 S. Broadway	Private Residence	Not Available
84.	Home Theater	1879 S. Broadway	Not Available	Not Available
85.	Metro Graphics	1871 S. Broadway	Print shop	Over 25 years
86.	Second Sound, Inc.	1879 S. Broadway	Buy, sell and trade new and used home audio equipment	Over 10 years
87.	Not Available	1899 S. Broadway	Formerly piano movers and tuners	Not Available
88.	Hill Bros. Boots	1901 S. Broadway (were across the street for 20 years)	Retail boots (formerly Schwinn bike shop)	Approx. 15 years
89.	Intrinsic Sound	1907 S. Broadway	Custom audio	Approx. 25 years
90.	Kroonenburg Lumber	1909 S. Broadway	Lumber yard and storage	Over 15 years
91.	Gift Shop	1951 and 1957 S. Broadway	Sale of gift items	Not Available
92.	Vintage Costumes	1959 S. Broadway	Vintage clothing and costumes	Not Available
93.	Nathan's Bar	1967 S. Broadway	Bar	Not Available
94.	Sherman Used Cars	1995 S. Broadway	Used cars	Not Available

95.	Trade Bindery	43 W. Asbury	Not Available	Not Available

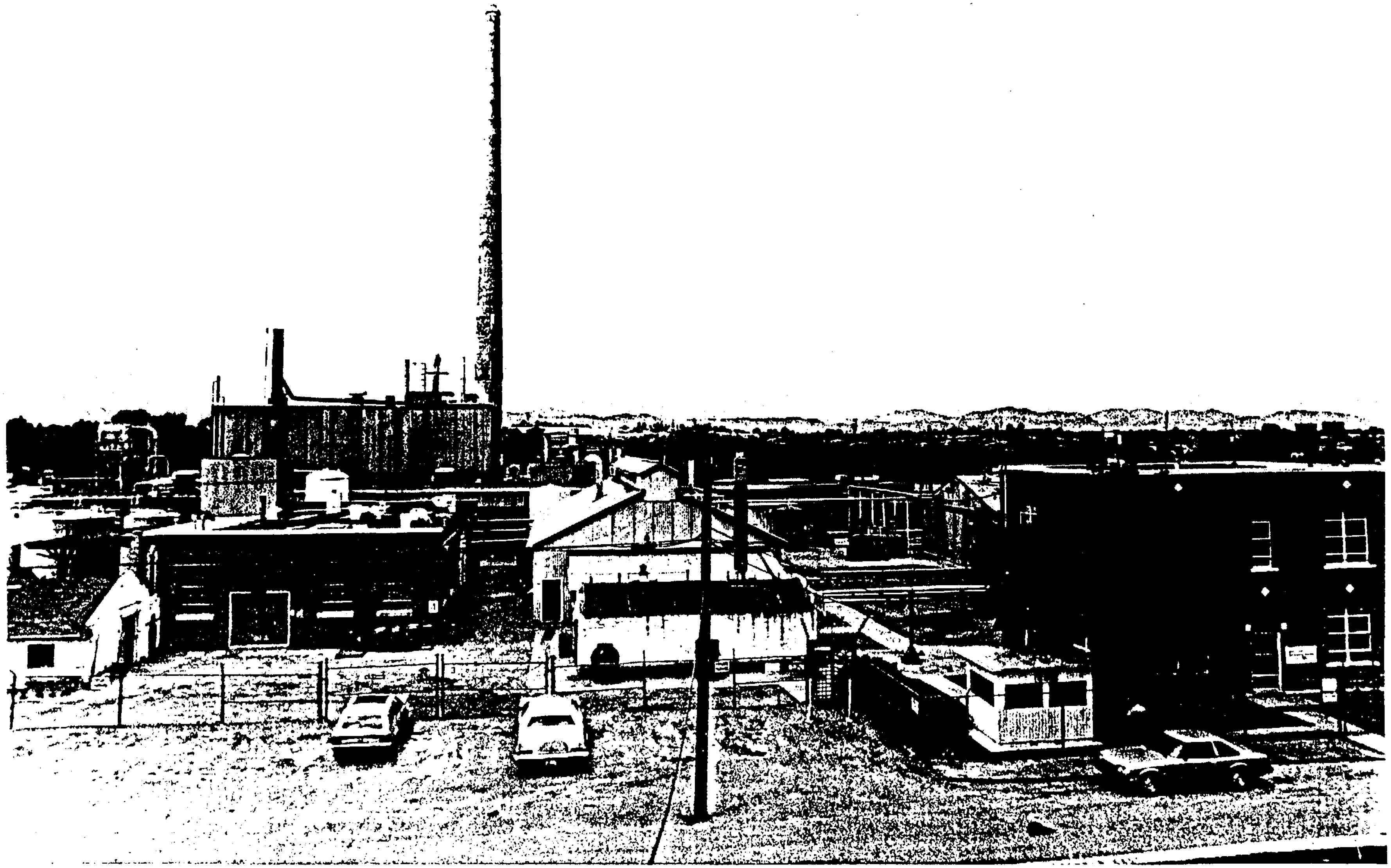


Figure 3

Picture of Site Prior to Building Demolition

BANPHOTO

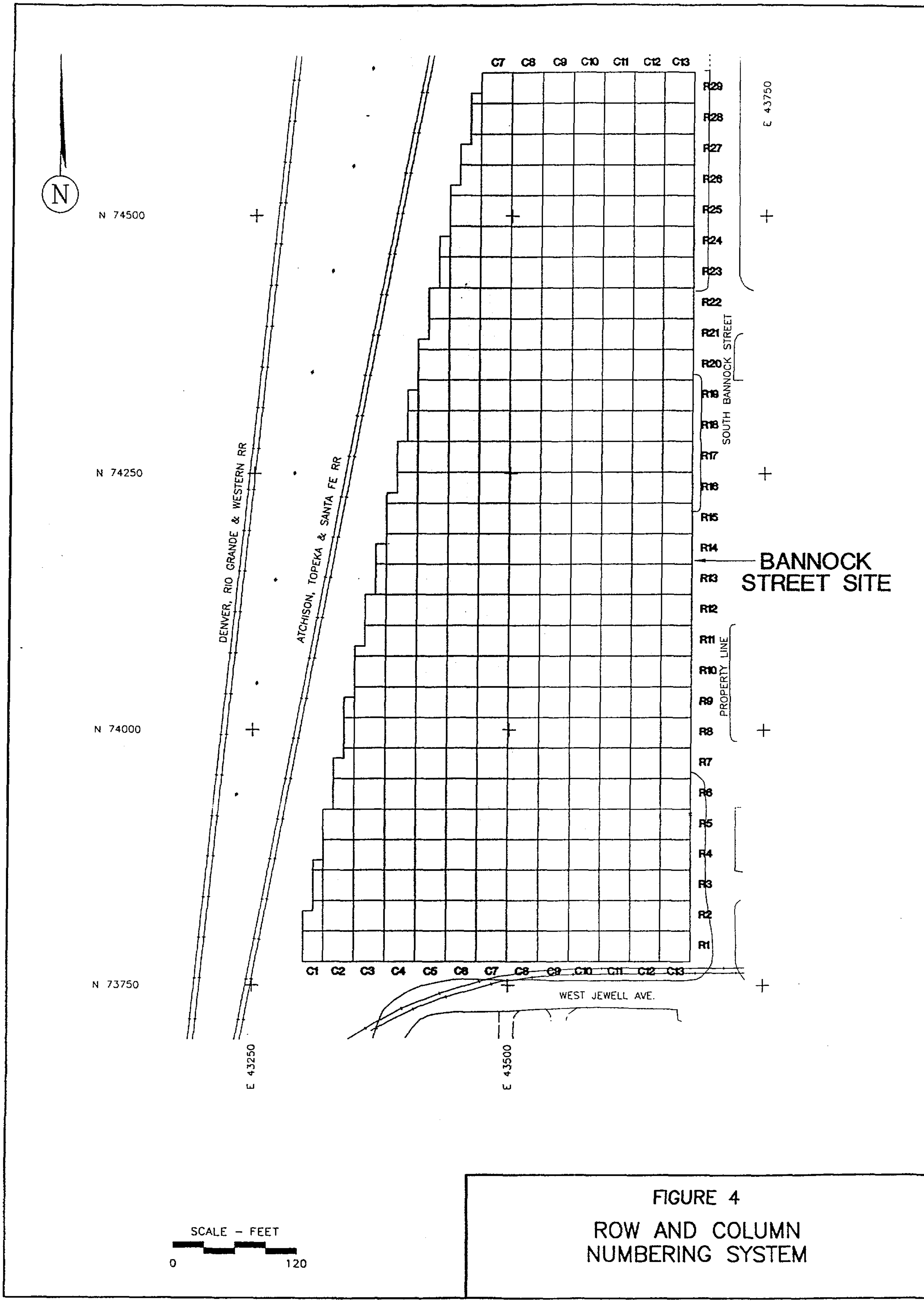


FIGURE 4

ROW AND COLUMN NUMBERING SYSTEM

0886033

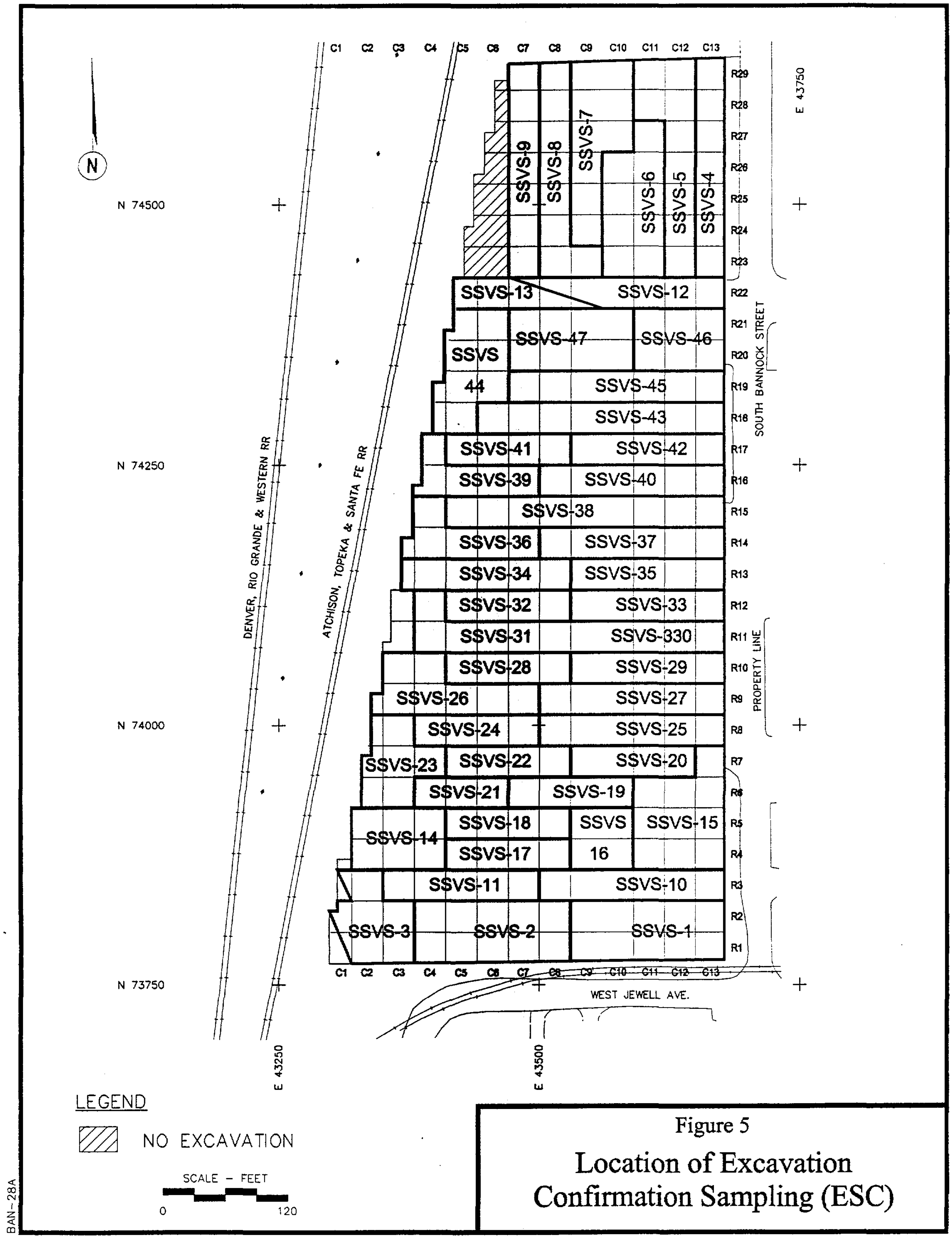


Figure 5

Location of Excavation Confirmation Sampling (ESC)

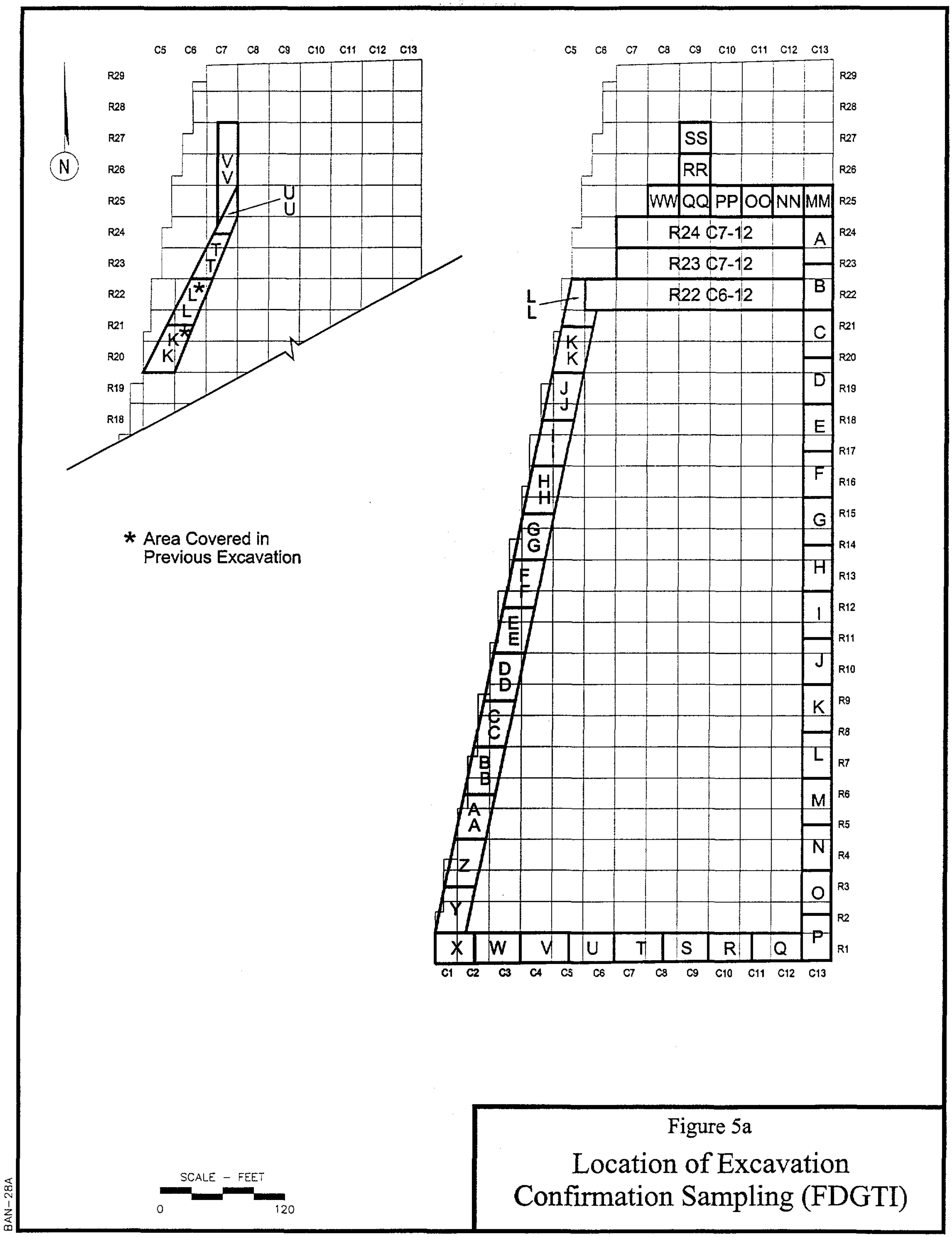
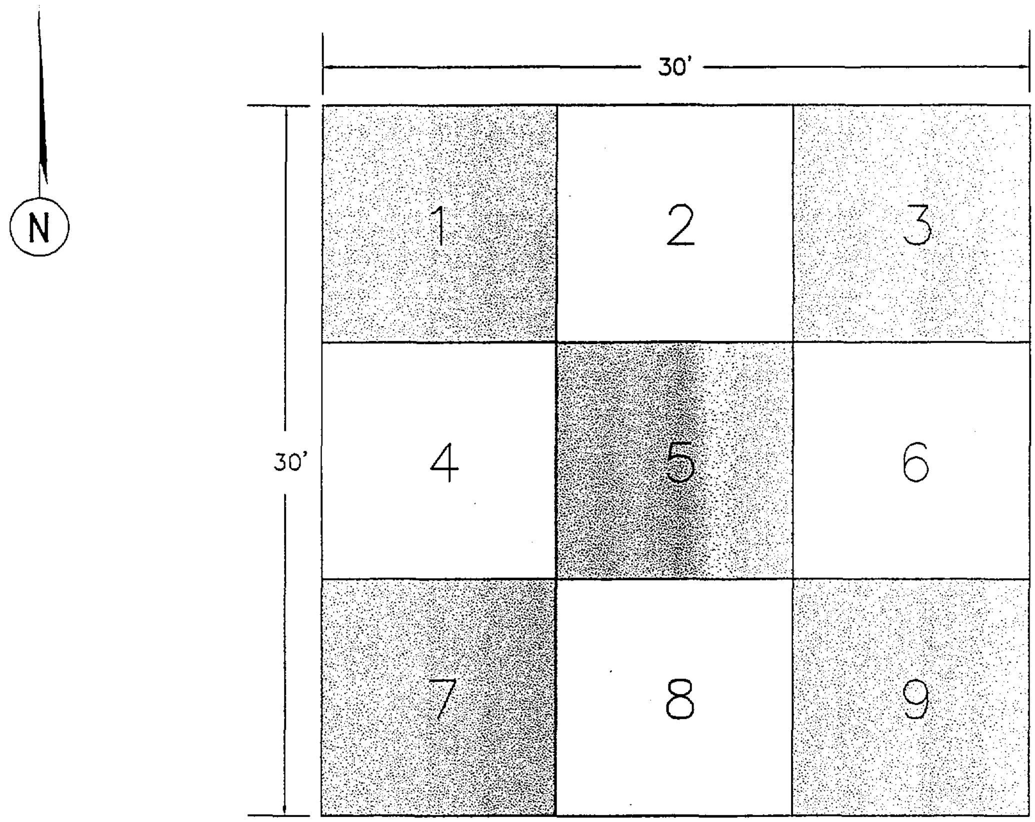


Figure 5a

Location of Excavation Confirmation Sampling (FDGTI)



LEGEND

INDICATES GRIDS USED FOR GENERATING COMPOSITE CONFIRMATION SAMPLE

SCALE – FEET

0 10

Figure 6

Grid Numbering System

BAN-30A

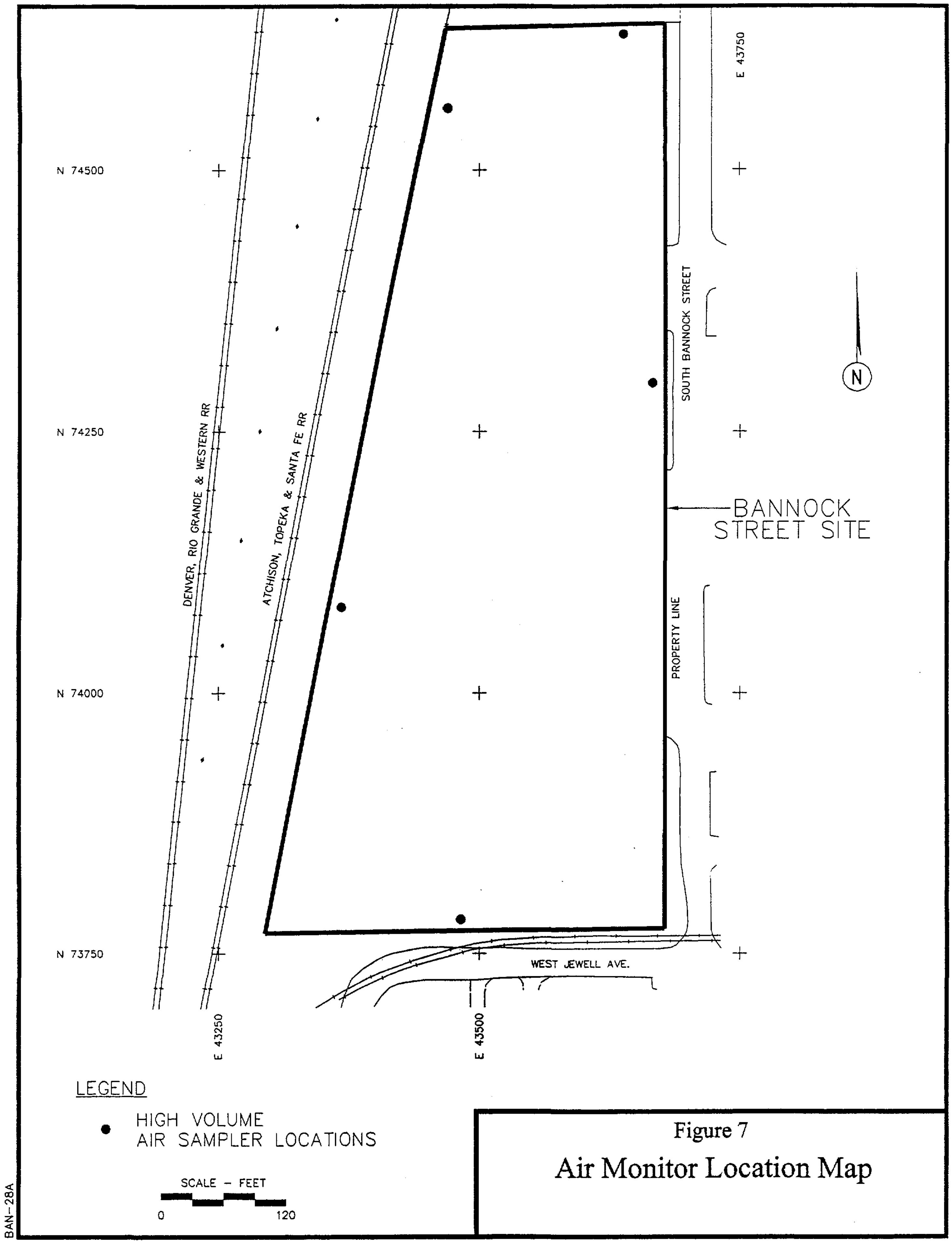
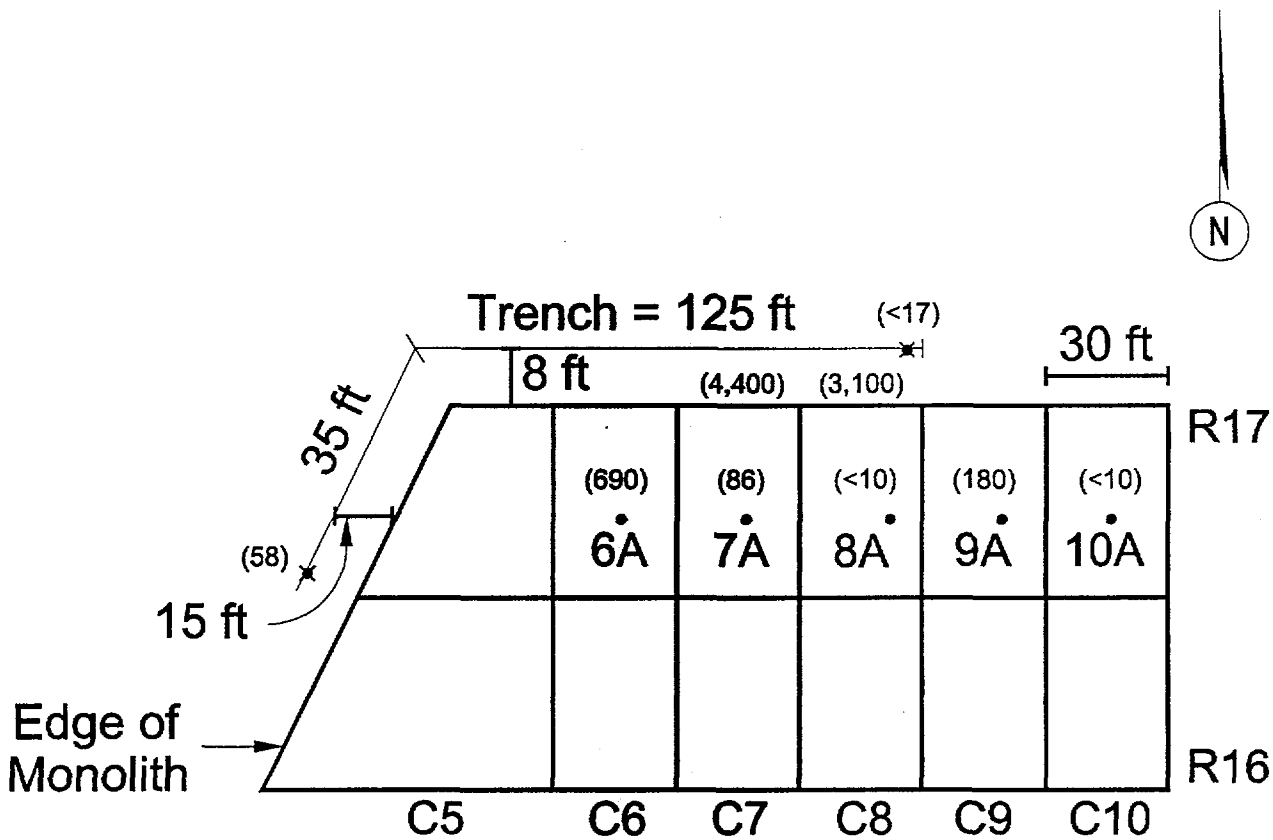


Figure 7

Air Monitor Location Map



Legend

✱ Soil sample locations

• 6A Boring location

(<10) Sampling results - mg/kg TPH as diesel

Figure 8

Location of Oil-Impacted Soil Samples and ORC Placement

BANFIG08

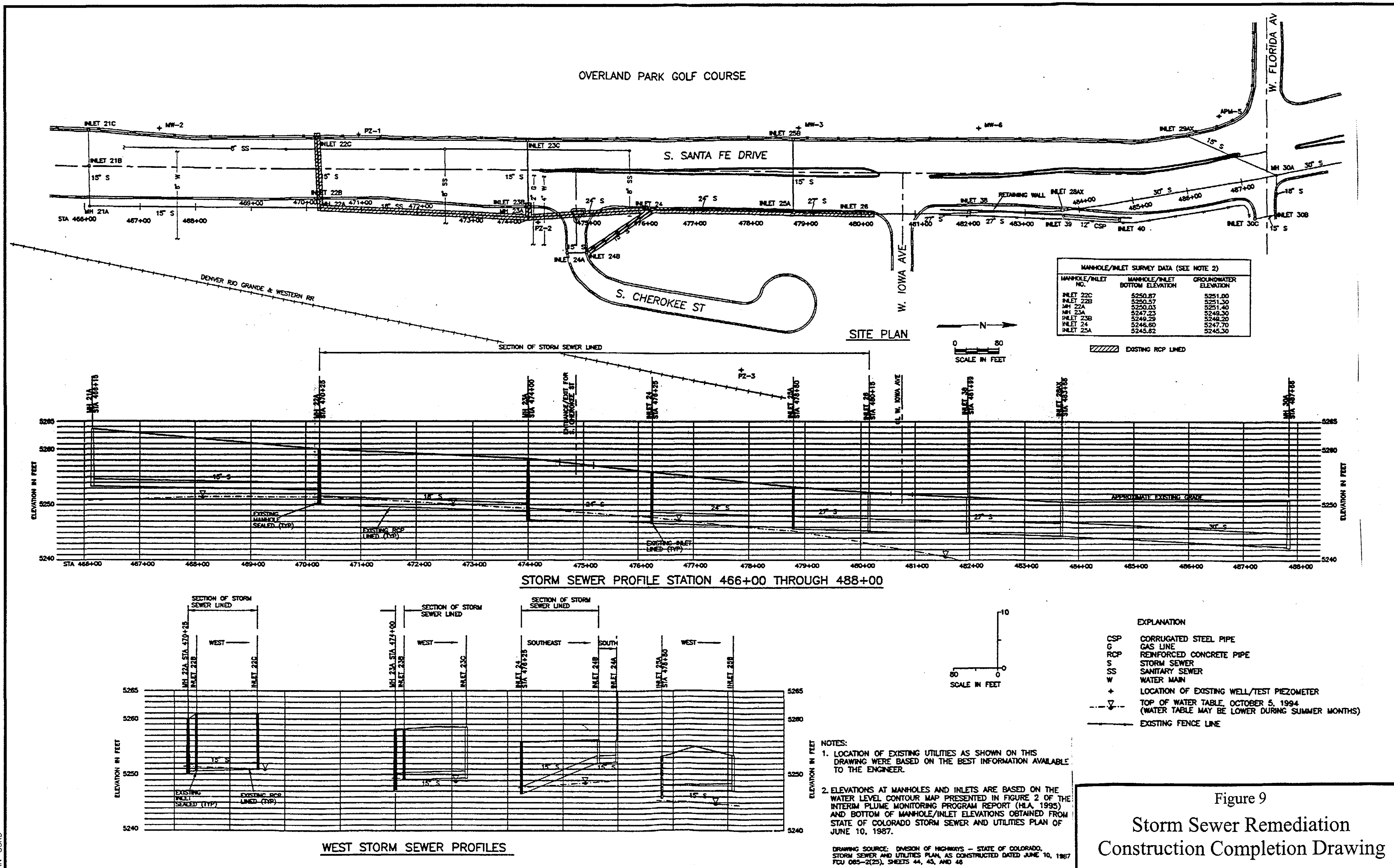
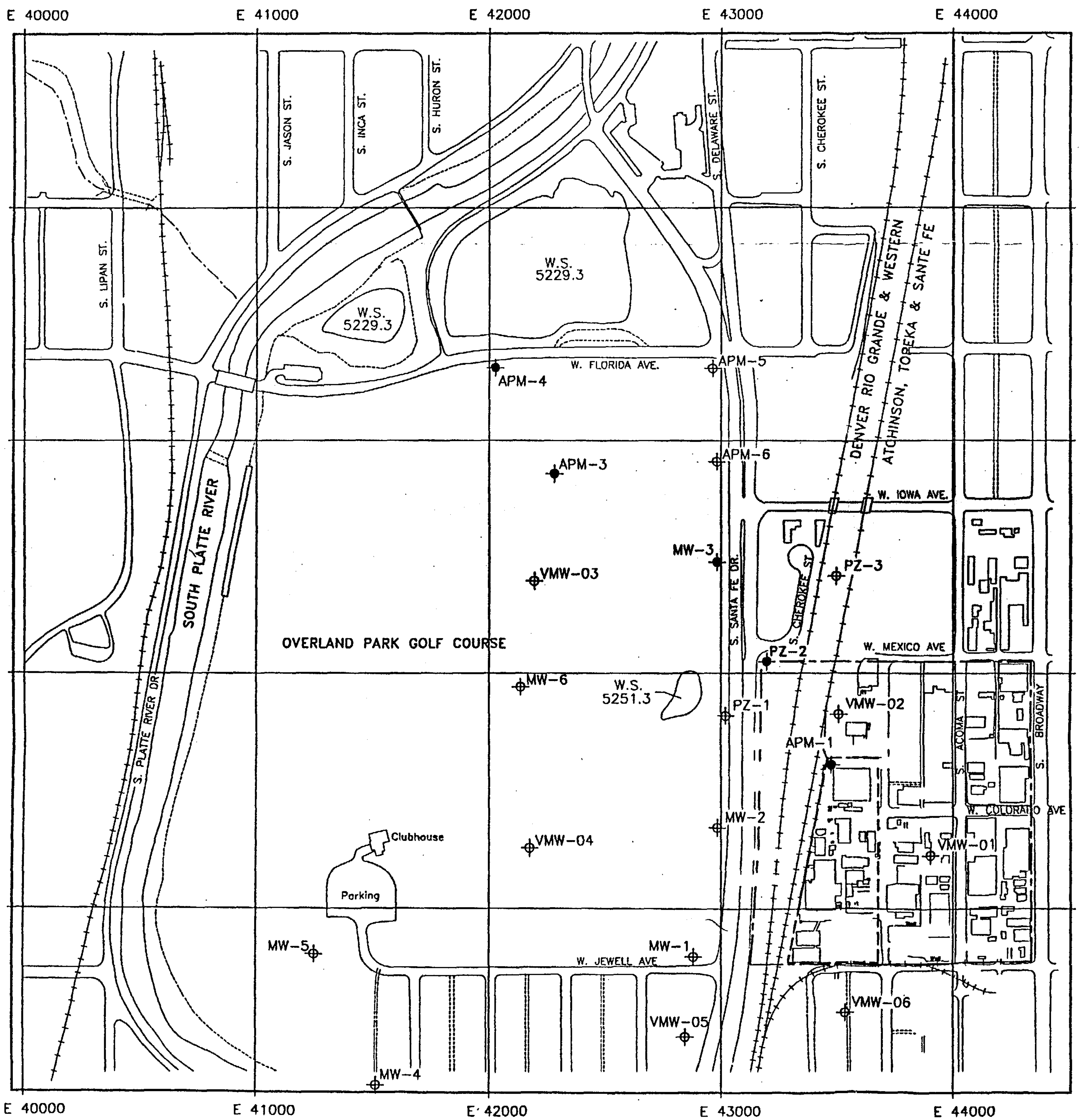


Figure 9

Storm Sewer Remediation Construction Completion Drawing

BAN-SSRD



Explanation

MW-3 Plume monitoring wells

Other wells

Bannock Street Site boundary

Denver Radium Site, Operable Unit VIII boundary

Note: MW-5, PZ-1 and PZ-3 are no longer present.

N

0 250 500

Scale in feet

Figure 10

Location of Plume Monitoring and Other Wells

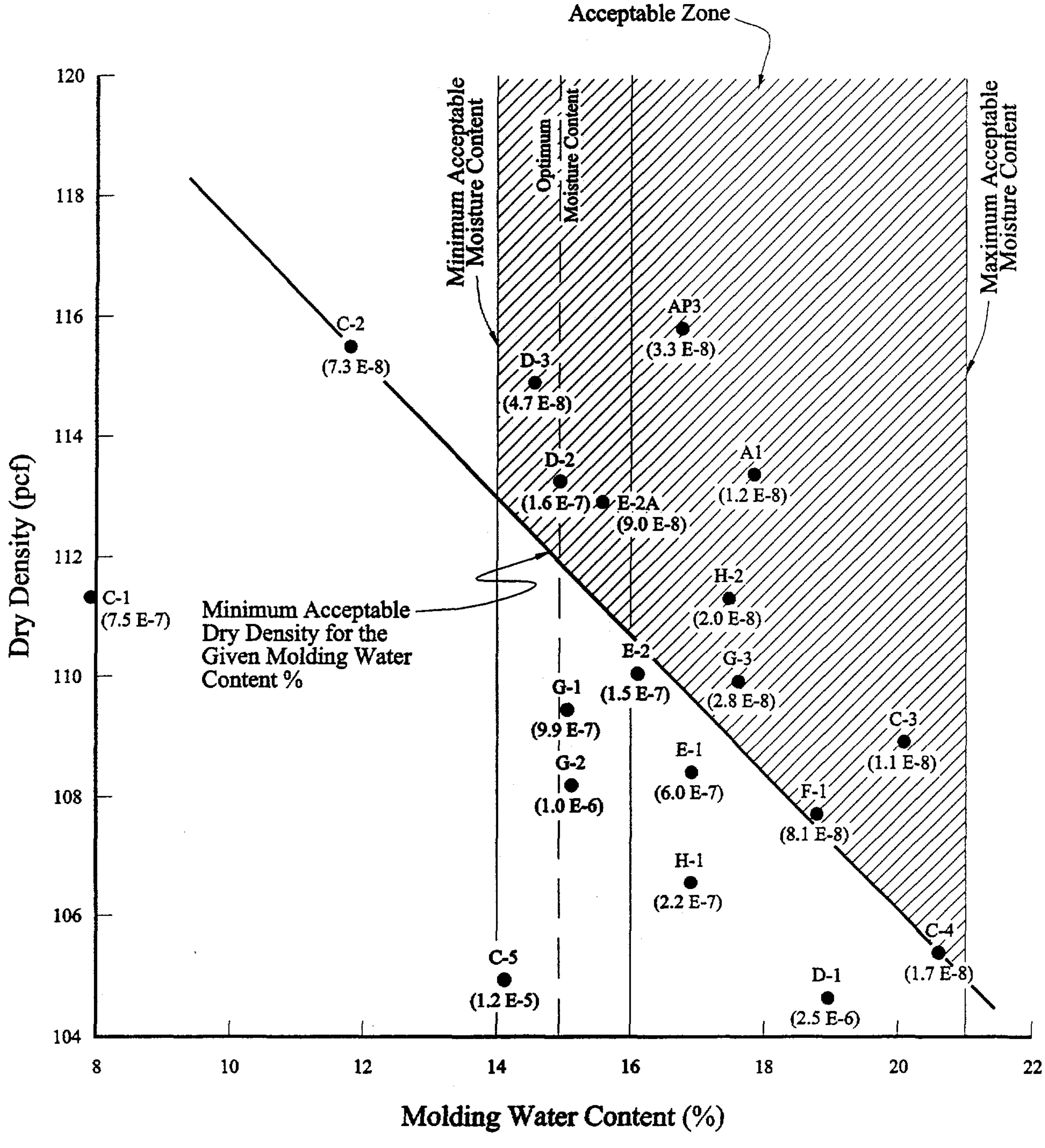


Figure 11

Clay Cover Density/Molding Water Content and Permeability Relationship

BAN-GRPH

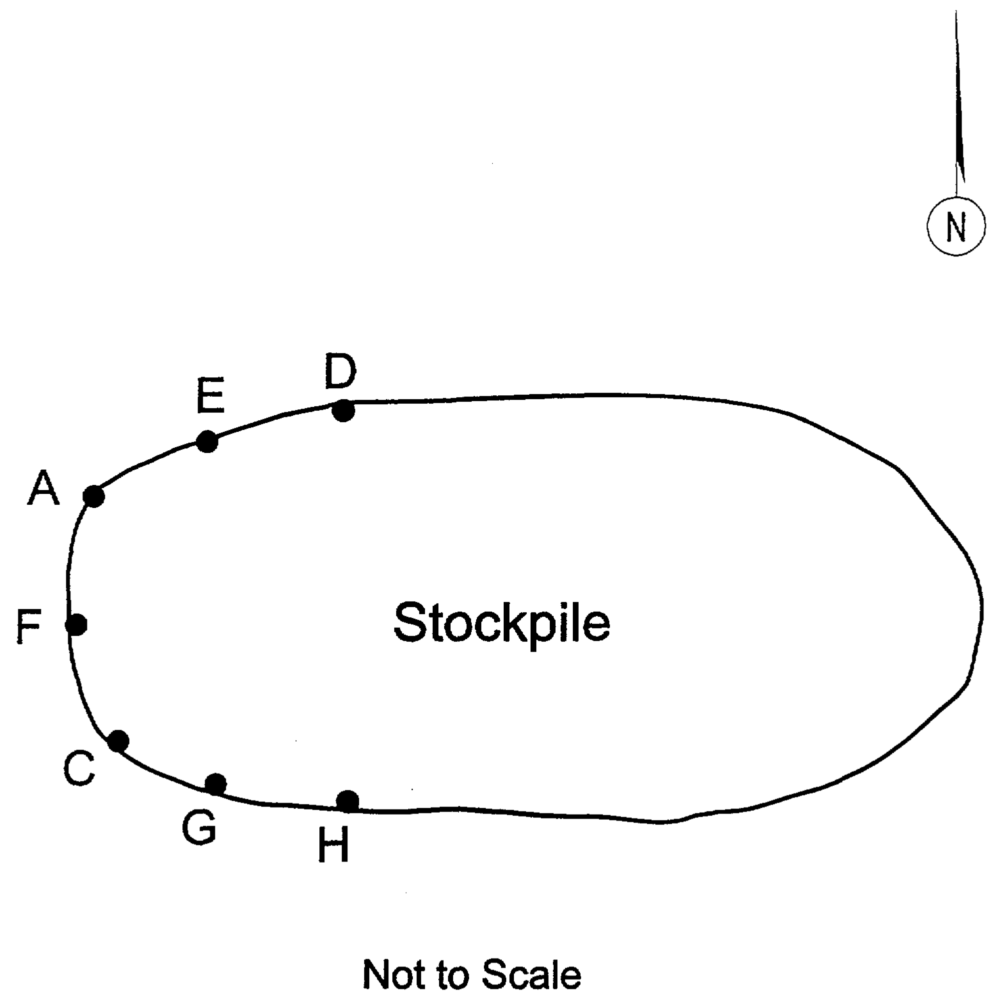


Figure 12

Location of RSCL Samples from BlueStone Aggregate Company Stockpile

BANFIG12

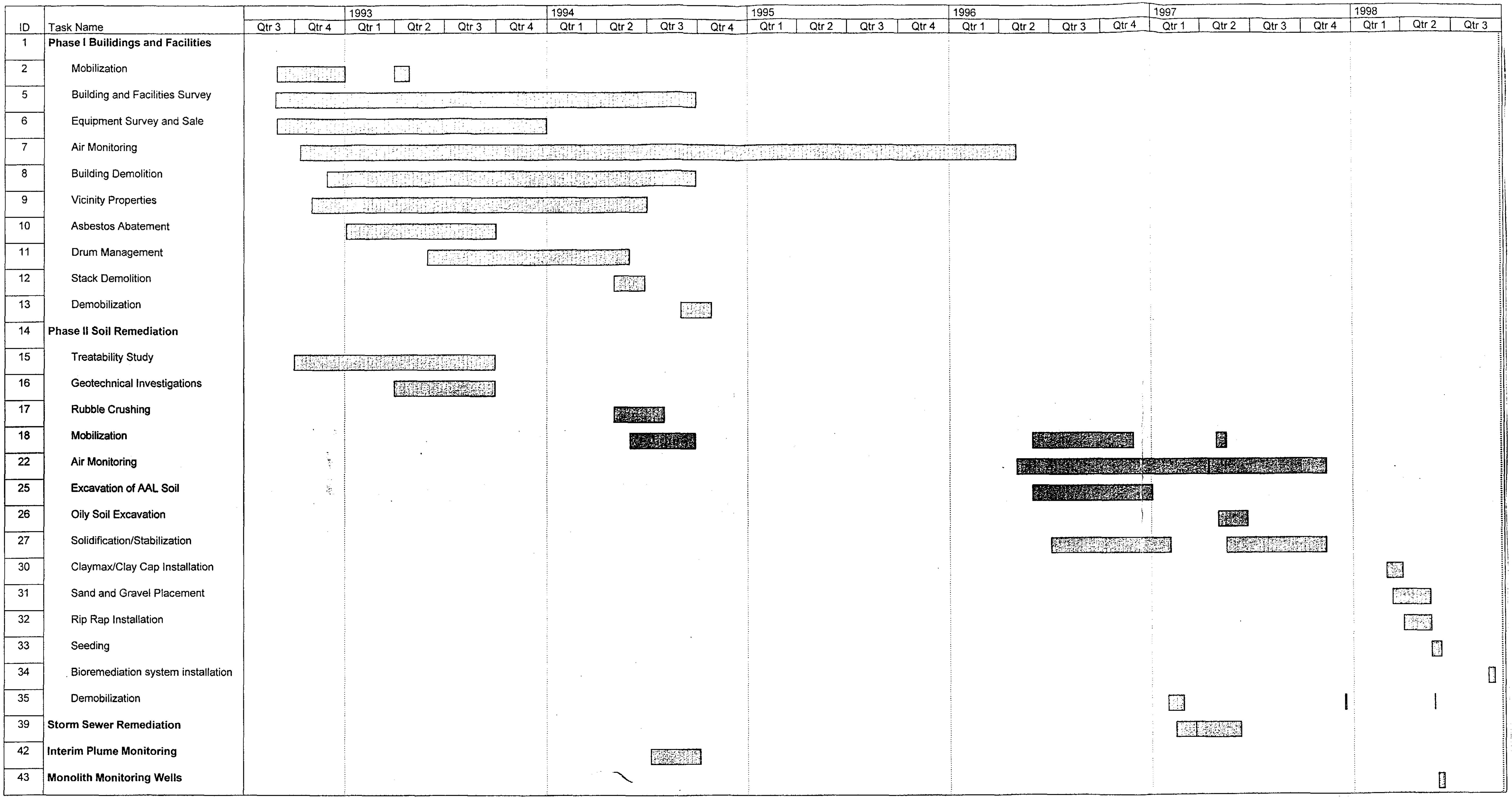


Figure 13

Overall Project Remediation Schedule

BANFIG13

TA 1 - IVI LES OT SUB TALS

DOCUMENT TITLE	SUBMITTAL TO EPA	EPA COMMENTS	RESPONSE TO COMMENTS	AGENCY APPROVAL	FINAL SUBMITTAL/ RESPONSE TO COMMENTS
Notice of Intent to Comply	9/8/92				
Notice of UAO to Contractors	9/8/92				
Notice of Project Manager	9/8/92			9/11/92	
Notice of Disposal Facilities	9/15/92 11/10/93			9/24/92 (partial) 11/15/93	
Notice of Recording and Indexing UAO to Property Titles	9/21/92 10/13/92				
Notice of Status of Access Agreements	9/30/92				
Documentation of Insurance	10/14/92				
Notice of Contractors	11/10/92 4/10/97			11/17/92	
Notice of Off-Site Shipment of Radioactive Waste	12/4/92				
Notice of Subcontractors	3/25/93			3/26/93	
Notice of Additional Subcontractors	6/29/93			6/29/93	
Notice of Additional Laboratories	8/11/93			8/12/93	
Notice of Change in Construction Inspector	8/12/93			8/13/93	
Demonstration of Financial Assurance		8/25/93 – request for financial assurance	9/2/93		
Proposal to Ship Waste Debris Off-Site	9/30/96			10/2/96	

DOCUMENT TITLE	SUBMITTAL TO EPA	EPA COMMENTS	RESPONSE TO COMMENTS	AGENCY APPROVAL	FINAL SUBMITTAL/ RESPONSE TO COMMENTS
Phase I Mobilization Plan	9/21/92	9/30/92	10/20/92	10/26/92	
Modification No.1	11/5/92			11/6/92 (verbal approval) 11/9/92	
Modification No. 2	11/16/92			11/17/92	
Phase I Buildings/Facilities Work Plan	9/21/92			12/17/92 (w/comments) 2/16/93	1/4/93
Phase I Sampling and Analysis Plan	9/21/92			1/19/93 (w/comments)	2/8/93
Amendment No. 1	11/23/93			5/5/94	
Phase I Quality Assurance Project Plan	9/21/92			1/19/93 (w/comments)	2/8/93
Phase I Site Safety Plan	9/21/92	12/15/92	1/5/93		
Removal of Sold Equipment Work Plan					
Draft	9/21/92	9/30/92	10/30/92		
Final	10/30/92			11/17/92 (w/comments)	11/19/92, 11/24/92
Modification	6/9/93			6/9/93	

DOCUMENT TITLE	SUBMITTAL TO EPA	EPA COMMENTS	RESPONSE TO COMMENTS	AGENCY APPROVAL	FINAL SUBMITTAL/ RESPONSE TO COMMENTS
Radioactivity Survey Reports, Sold Equipment					
• Sold Equipment, Forklift	6/23/93				
• Tool Room Sold Equipment	3/12/93				
• Survey and Polychlorinated Biphenyl Screening, Electrical Transformers	3/5/93				
• PCB Capacitors	9/16/93				
• Duwald Shipment 1	9/17/93				
• Duwald Shipment 2	10/28/93				
• Duwald Shipment 3	11/2/93				
• Duwald Shipment 4	11/15/93				
• Duwald Shipment 5	11/29/93				
• Duwald Shipment 6	12/16/93				
• Duwald Shipment 7	1/5/94				
• AAA Molybdenum Equipment	5/20/93				
• Group 1 Sold Equipment	3/5/93				
• Group 2 Sold Equipment	2/2/93				
• Group 2 Addendum	5/7/93				
• Group 3 Sold Equipment	12/10/93				
• Group 4 Sold Equipment	7/22/93				
• Group 5 Sold Equipment	3/5/93				

DOCUMENT TITLE	SUBMITTAL TO EPA	EPA COMMENTS	RESPONSE TO COMMENTS	AGENCY APPROVAL	FINAL SUBMITTAL/ RESPONSE TO COMMENTS
Asbestos-Containing Materials Removal Work Plan Amendment No. 1 Radioactivity Survey Report, Asbestos-Containing Materials	9/21/92 9/8/93 9/15/92	10/20/92	12/4/92	12/7/92 9/15/93	
Health and Safety Plan, Equipment Dismantling, Demolition and Removal Activities	9/21/92 11/13/92 (Amended response)	10/14/92 12/3/92	10/30/92 1/13/93	 2/8/93	
Building No. 4 Management Activities Work Plan Radioactivity Survey Building No.4	9/30/92 10/30/92	10/20/92	10/30/92	**11/17/92 (w/conditions)** **11/18/92 (approval of demolition of Bldg. 4 w/conditions)**	 **11/20/92 (Response to conditional approval)**
Buildings No. 1 and No. 3 Management Activities Work Plan Building No. 1 Radioactivity Survey Building No. 3 Radioactivity Survey	10/15/92 11/16/92 12/11/92	10/26/92	11/13/92	12/4/92 (w/conditions)	
Field Operations Work Plan, Piezometer Installation	11/24/92			12/31/92 (w/comments)	1/26/93

DOCUMENT TITLE	SUBMITTAL TO EPA	EPA COMMENTS	RESPONSE TO COMMENTS	AGENCY APPROVAL	FINAL SUBMITTAL/ RESPONSE TO COMMENTS
Piezometer Installation Report	11/4/93				
Storage of Water from Decontamination Activities		12/7/92	12/17/92	12/22/92	
Trailers and Equipment/Facility Components Management Activities Work Plan Radioactivity Survey Report Trailers and South Pad Equipment/Facility Components	12/22/92 12/24/92			12/23/92	
Building Slabs and Substructures Removal Activities	1/15/93	2/16/93	3/18/93	3/26/93	
Rubble Crushing Plan Notice of Consolidation of Vicinity Property Stockpiles and Stage II Rubble Crushing Locations	1/15/93 3/28/94	3/29/94	4/6/94	1/25/93 (w/comments) 4/8/94	1/28/93

DOCUMENT TITLE	SUBMITTAL TO EPA	EPA COMMENTS	RESPONSE TO COMMENTS	AGENCY APPROVAL	FINAL SUBMITTAL/ RESPONSE TO COMMENTS
Other Buildings/Facilities and Equipment Management Activities Work Plan	1/15/93	2/16/93	3/18/93	3/26/93	
Modification (Bldg. Nos. 5 & 6)	7/22/93			8/3/93 (w/comments) 8/13/93 (demolition Bldg. 5 modification)	
Radioactivity Survey Report Building No. 2	4/9/93			4/12/93	
Surveying Activities (Non-Scannable Materials)	9/22/93	10/22/93			
Miscellaneous Materials (Sampling and Analytical Methods)	2/2/94				

DOCUMENT TITLE	SUBMITTAL TO EPA	EPA COMMENTS	RESPONSE TO COMMENTS	AGENCY APPROVAL	FINAL SUBMITTAL/ RESPONSE TO COMMENTS
Radioactivity Survey Reports Processing Equipment and Building Fixtures Shipments:					
1	3/10/93				
2 & 3	3/19/93				
4	4/7/93				
5	4/23/93				
6	5/4/93				
7	5/18/93				
8	5/20/93				
9	5/28/93				
10	6/7/93				
11	6/16/93				
12	6/23/93				
13	7/1/93				
14	7/12/93	7/26/93	8/16/93		
15	8/9/93				
16	8/18/93				
17	8/27/93				
18	9/8/93				
19	9/14/93				
20	9/20/93				
21	9/22/93				
22	10/1/93				
23	10/7/93				
24	10/14/93				
25	10/22/93				
26	11/2/93				
27	11/29/93				
28	12/30/93				

DOCUMENT TITLE	SUBMITTAL TO EPA	EPA COMMENTS	RESPONSE TO COMMENTS	AGENCY APPROVAL	FINAL SUBMITTAL/ RESPONSE TO COMMENTS
Underground Utilities Removal Activities Work Plan	1/15/93	3/22/93	4/5/93	4/5/93	
Amendment No. 1	10/13/93			10/14/93	
Underground Storage Tank Removal Activities Work Plan	3/12/93	4/20/93	5/14/93	5/17/93	
Drum Management Activities Work Plan	5/14/93				
Amendment	6/3/93	6/4/93 (on 5/14/93 & 6/3/93 submittals)	6/18/93	6/18/93	
Amendment No. 1	7/19/93			7/20/93	
Additional EPA Comments		8/12/93			
Amendment No. 2	8/24/93			8/25/93 (w/comments)	
Amendment No. 3	11/16/93			11/18/93	
Amendment No. 4	11/17/93	12/30/93	1/5/94	1/24/94	
Amendment No. 5	12/3/93			12/16/93 (partial approval) 12/30/93 (full)	
Radioactivity Survey Report	11/23/93				
Radioactivity Survey Report, Addendum	11/30/93				
Radioactivity Survey Report, Addendum	12/21/93				

DOCUMENT TITLE	SUBMITTAL TO EPA	EPA COMMENTS	RESPONSE TO COMMENTS	AGENCY APPROVAL	FINAL SUBMITTAL/ RESPONSE TO COMMENTS
Radioactivity Survey Report, Lab-Pack	11/19/93				
Stack Removal Activities Work Plan	8/20/93			9/15/93	
Submittal of Subcontractor Qualifications	8/27/93			8/27/93	
Confirmation of 11/7/93 Demolition Date	9/24/93				
Response to CDH Concerns	11/19/93				
Amendment No. 1 (Management of stack materials)	11/24/93	2/9/94 (CDH-Air Pollution Control Division)			
Modification to Amendment No. 1 (Elasto Seal application)	3/18/94	3/25/94 (CDH-Air Pollution Control Division)	4/14/94, 5/4/94	5/6/94 (conditioned on providing air monitoring results of test)	
Air Monitoring Results of Test	5/25/94			5/31/94	

DOCUMENT TITLE	SUBMITTAL TO EPA	EPA COMMENTS	RESPONSE TO COMMENTS	AGENCY APPROVAL	FINAL SUBMITTAL/ RESPONSE TO COMMENTS
Danielson Construction Company RD/RA Work Plan (RJR Circuits and Kroonenberg Lumber)	2/2/93	3/2/93	3/19/93	3/26/93	
Amendment No. 1	9/13/93			9/13/93	
Amendment No. 2	10/26/93			11/1/93	
Radioactivity Survey Report	12/29/93				
Construction Pre-Certification Notice	3/28/94	3/29/94			
Construction Completion Report	5/9/94			5/9/94	
Danielson Perimeter Air Monitoring Results	6/28/94				
Dade and Pugliese Properties Work Plan	2/5/93	3/2/93	3/19/93	3/26/93 (w/comments)	
Construction Pre-Certification Notice	9/2/93	9/15/93			
Construction Completion Report	11/5/93			11/9/93	
Additional Work – Damaged Trees	7/26/95			8/16/95 (w/modifications)	

DOCUMENT TITLE	SUBMITTAL TO EPA	EPA COMMENTS	RESPONSE TO COMMENTS	AGENCY APPROVAL	FINAL SUBMITTAL/ RESPONSE TO COMMENTS
Vicinity Property Investigation Work Plan	2/5/93	3/18/93	3/31/93	3/31/93	
Amendment No. 1	6/24/93			6/28/93	
Additional Centennial Investigation Results	8/5/93			8/12/93	
Additional Flanagan Investigation Results	8/16/93				
Vicinity Properties Construction Quality Assurance Plan	2/19/93			3/22/93 (w/comments) 4/5/93	4/2/93
Amendment re Construction Inspector	8/12/93			8/13/93	
Amendment	10/14/93			10/19/93	
South Bannock Street Investigation Work Plan	3/10/93	4/1/93 Request for Revised Draft Work Plan			
Revised Work Plan	4/16/93	5/4/93	5/21/93	5/21/93	
Preliminary Results of Investigation	7/22/93				
Final Report	8/4/93				
Addendum – Final Report	8/31/93				
Addendum 2 – Final Report	10/19/93				

DOCUMENT TITLE	SUBMITTAL TO EPA	EPA COMMENTS	RESPONSE TO COMMENTS	AGENCY APPROVAL	FINAL SUBMITTAL/ RESPONSE TO COMMENTS
Additional Investigation	11/5/96	12/30/96 (Requesting Work Plan)	1/10/97 (Requesting Extension to Submit Plan)		
South Bannock Street Work Plan	2/5/97	2/18/97 5/9/97 (Request to Commence Work) 5/30/97	2/28/97 5/27/97 (Acknowledge-ment)	3/11/97	
Pre-Certification Inspection Notice		8/12/97			
Construction Completion Report	8/20/97				
South Bannock Street Shoulder RD/RA Work Plan	3/19/93	4/20/93	5/7/93	5/10/93	
Modification	6/30/93			7/1/93	
Modification	7/1/93			7/6/93	
Modification	7/22/93			7/29/93	
Modification	8/4/93			8/4/93	
Analytical Results	8/25/93	8/27/93			
Construction Pre-Certification Notice	12/3/93				
Construction Completion	1/27/94			1/27/94	

DOCUMENT TITLE	SUBMITTAL TO EPA	EPA COMMENTS	RESPONSE TO COMMENTS	AGENCY APPROVAL	FINAL SUBMITTAL/ RESPONSE TO COMMENTS
Report Sachs Lawlor Driveway Investigation Results	10/5/93				
Construction Pre-Certification Notice	10/5/93			10/6/93	
Construction Completion Report	11/5/93			11/9/93	
Railroad Right-of-Way Investigation Work Plan	4/21/93	5/20/93	5/21/93	5/21/93	
Railroad Right-of-Way Investigation Final Report	**9/21/93**	**12/16/93**	**12/22/93**	**12/22/93**	**12/25/93 Response to Santa Fe comments**
Atchison, Topeka and Santa Fe Railroad Right-of-Way RD/RA Work Plan	**10/15/93**			**1/24/94**	
Amendment No. 1	1/24/94	11/24/94			
Results of Area Averaging – Thorium-230	3/17/94	5/2/94	5/20/94, 5/23/94		
Construction Pre-Certification Notice	4/22/94				
Precertification Inspection		4/25/94			
Construction Completion Report	6/3/94			6/20/94	

DOCUMENT TITLE	SUBMITTAL TO EPA	EPA COMMENTS	RESPONSE TO COMMENTS	AGENCY APPROVAL	FINAL SUBMITTAL/ RESPONSE TO COMMENTS
Centennial Air Conditioning and Heating Co. RD/RA					
Draft Work Plan	8/18/93	8/23/93	8/23/93	8/24/93	
Construction Pre-Certification Notice	9/27/93			10/4/93	
Construction Completion Report	11/5/93			11/9/93	
Flanagan Ready Mix Ltd. RD/RA					
Draft Work Plan	8/18/93	8/23/93	8/24/93	8/24/93	
Construction Pre-Certification Notice	12/3/93				
Construction Completion Report	1/27/94			1/27/94	
Notification of Additional Excavation Requirements	2/25/94			2/25/94	

DOCUMENT TITLE	SUBMITTAL TO EPA	EPA COMMENTS	RESPONSE TO COMMENTS	AGENCY APPROVAL	FINAL SUBMITTAL/ RESPONSE TO COMMENTS
Phase II Draft Work Plan	9/30/92	2/26/93	3/29/93	3/31/93	
Phase II Site Safety Plan	9/30/92				
Amendment No. 1	1/26/93	2/9/93	3/3/93		
Amendment No. 2	5/9/94	7/6/94	8/5/94	8/12/94 (Acknowledgement of receipt)	
Pilot Scale Treatability Study					
Phase II Draft Work Plan	10/2/92	12/16/92	12/31/92	1/21/93 (w/comments)	
Amendment No. 1 (Building No. 5)	12/17/92			12/22/92	
Amendment No. 2	4/22/93			4/26/93	
Amendment No. 3	5/10/93	5/20/93	5/21/93	5/21/93	
Operations Plan	12/31/92				
Corrections to Operations Plan	1/6/93				
Notification of Sampling & Analysis (First & Second Phases)	11/19/92			12/4/92 (approval of First Phase)	
Request for approval of Second Phase	1/6/93			1/16/93	
Notification of Additional Sampling & Analysis	12/22/92			12/22/92	12/29/92 (rescheduling of sampling)
Notification of Laboratories and Analytical Protocols	1/27/93 3/10/93			3/11/93	

DOCUMENT TITLE	SUBMITTAL TO EPA	EPA COMMENTS	RESPONSE TO COMMENTS	AGENCY APPROVAL	FINAL SUBMITTAL/ RESPONSE TO COMMENTS
Radon Testing of Monolith	3/10/93 (meeting)			3/11/93	
Notification of Change of Laboratory	3/24/93			3/24/93	
Draft Pilot Scale Treatability Study Report	6/21/93				
Final Pilot Scale Treatability Study Report	7/20/93				
Addendum	2/1/94	5/10/94			
Phase II SAP	10/15/92	3/12/93	4/1/93	4/1/93	
Addendum No. 1 (HLA)	4/16/93	4/5/94	5/11/94	5/23/94	12/9/97
Amendment No. 2	5/9/94	8/25/94	9/19/94	11/14/94	
Geotechnical Program Amendment No. 1	4/23/93			4/26/93	
Amendment No. 2	9/2/93			9/2/93	
Notification of start of Geotechnical Investigation Program	4/6/93			4/6/93	
Phase II QAPP	10/15/92	2/8/93	3/18/93	3/31/93	
Addendum No. 1 (HLA)	4/16/93	4/5/94	5/11/94	5/12/94	12/9/97
Amendment No. 2	5/9/94			7/6/94	

DOCUMENT TITLE	SUBMITTAL TO EPA	EPA COMMENTS	RESPONSE TO COMMENTS	AGENCY APPROVAL	FINAL SUBMITTAL/ RESPONSE TO COMMENTS
Monolith Monitoring Plan					
Draft	4/16/93	6/25/97	7/31/97		
Draft Final	12/9/97	2/10/98	2/24/98	2/25/98	5/7/98
Plume Monitoring Plan					
Draft	4/16/93	6/25/97	7/31/97		
Draft Final	12/9/97	2/10/98	3/26/98	4/2/98	5/1/98
Addendum No. 1	11/4/93	4/5/94 5/18/94	5/11/94 6/17/94	6/23/94	
Interim Plume Monitoring Program Report	2/3/95				
Groundwater Monitoring Program Site Safety and Health Plan	4/16/93			4/7/94	12/9/97
Phase II – Preliminary Design Report and Preliminary ARARs Assessment	4/27/93				
Phase II Intermediate Remedial Design Report (60%)	6/25/93	Informal Comments	4/19/94	5/10/94 (Design Report w/comments) 5/10/94 (Design Drawings w/comments)	
Monitoring Well Abandonment Activities	2/25/94 3/16/94			3/3/94 3/21/94	

DOCUMENT TITLE	SUBMITTAL TO EPA	EPA COMMENTS	RESPONSE TO COMMENTS	AGENCY APPROVAL	FINAL SUBMITTAL/ RESPONSE TO COMMENTS
Phase II Mobilization Plan	3/4/94	4/13/94	4/25/94	5/6/94	
Modifications	7/18/94			7/18/94	
Modification	8/5/94			8/12/94	
Modifications	8/23/94			8/23/94	
Mobilization Schedule	6/3/96 6/7/96 6/26/96			6/11/96	
Phase II Construction Quality Assurance Plan	5/9/94	8/12/94	9/2/94	10/3/94	
Phase II Prefinal Remedial Design Report (90%) (3 vols.)	5/9/94	**Informal Comments**	9/8/94		
Remedial Design Monolith Base Elevation	6/7/96				
Phase II Air Monitoring Plan	5/13/94	6/22/94	7/21/94	8/9/94	
Perimeter Air Quality Data Request	7/31/96 8/20/97 4/24/98				
Termination of Air Monitoring				11/13/97	
Phase II Operation and Maintenance Plan	6/13/94	3/16/98	7/16/98		

DOCUMENT TITLE	SUBMITTAL TO EPA	EPA COMMENTS	RESPONSE TO COMMENTS	AGENCY APPROVAL	FINAL SUBMITTAL/ RESPONSE TO COMMENTS
Sewer Remediation Plan	2/3/95	2/24/95 4/5/95 4/13/95	3/31/95 4/18/95	4/19/95	5/9/95
Revisions to Sewer Remediation Plan	8/3/95			8/8/95	
Notice of delay	9/20/95				
Response to City of Denver's Comments	11/1/95 3/29/96 11/5/96				
Construction Completion Report	**6/10/97**	**Verbal request for additional information**	**7/25/97**		

DOCUMENT TITLE	SUBMITTAL TO EPA	EPA COMMENTS	RESPONSE TO COMMENTS	AGENCY APPROVAL	FINAL SUBMITTAL/ RESPONSE TO COMMENTS
Phase II Final Remedial Design	6/10/96			6/27/96 partial approval	
Cover System		7/15/96 8/12/96 10/2/96	8/19/96 11/05/96 12/18/96		
	3/18/97 (final drawing)			3/20/97	
Revised Cover System Including: 1. Monolith Design Slope and Elevation	5/6/97 (meeting)			5/8/97 (w/requirements)	
	6/18/97 (revised documents and calculations)				
	6/25/97 (stockpile survey)				
	7/2/97 (construction sequencing plan)	7/11/97			

DOCUMENT TITLE	SUBMITTAL TO EPA	EPA COMMENTS	RESPONSE TO COMMENTS	AGENCY APPROVAL	FINAL SUBMITTAL/ RESPONSE TO COMMENTS
	8/15/97 (reconfiguration of top slope)	9/16/97	8/18/97 10/22/97		
	11/5/97 (additional 6inch lift on monolith)			11/13/97	
	11/7/97 (revised x-sections)			11/13/97 (w/comments)	
	12/18/97 (revised drawings)			2/12/98 (final approval of entire cover design)	
2. Recompacted Soil/ Clay Layer specification.	6/10/97	6/24/97 8/8/97 10/3/97 11/25/97 (request for revised specification)	 9/15/97 10/13/97		
	12/5/97 (revised specification)	12/10/97 12/23/97	12/16/97 1/8/98		
		1/15/98	1/22/98	2/12/98 (entire cover design)	

DOCUMENT TITLE	SUBMITTAL TO EPA	EPA COMMENTS	RESPONSE TO COMMENTS	AGENCY APPROVAL	FINAL SUBMITTAL/ RESPONSE TO COMMENTS
3. Geosynthetic Clay Liner		11/25/97	12/5/97	1/8/98	
Cover System Materials					
Clay Source for RSCL		9/4/97 (strength test requirements)	10/31/97	11/13/97	
Slope Stability Analysis	2/5/98 2/6/98 2/12/98				
Triaxial Strength Tests	12/29/97 12/31/97 12/31/97				
Optimum Moisture/ Compaction Figure	**2/2/98**				
Gravel Source	**9/23/97 10/23/97**			**4/1/98 4/7/98**	
Riprap Source	9/23/97 10/23/97 11/18/97 1/7/98 3/18/98	12/9/97(w/ comments) 3/24/98	3/27/98	4/1/98 4/7/98	5/28/98
Sand Source	9/23/97 10/23/97			11/13/97	
Geosynthetic Clay Liner	12/15/97 (QA/QC cert.) 3/31/98 (QA/QC cert.)				

DOCUMENT TITLE	SUBMITTAL TO EPA	EPA COMMENTS	RESPONSE TO COMMENTS	AGENCY APPROVAL	FINAL SUBMITTAL/ RESPONSE TO COMMENTS
Processing Materials Certifications					
Flyash	11/17/97				
Cement	9/23/97 11/17/97				
Final Remedial Action Work Plan	6/10/96			6/27/96	
Project Schedule – Delay in Activities		3/31/97	4/4/97		4/22/97
Construction of Cover System	10/22/97			11/13/97 (request for updated schedule)	
Phase II Document Compilation Volume including Site Safety Plan, SAP, QAPP, and CQAP	7/17/96 7/23/96				

DOCUMENT TITLE	SUBMITTAL TO EPA	EPA COMMENTS	RESPONSE TO COMMENTS	AGENCY APPROVAL	FINAL SUBMITTAL/ RESPONSE TO COMMENTS
• **Phase II Remedial Design Modifications**					
• Modification of Construction Technique (vertical cold joints)	9/4/96			9/9/96	
• Modification re Ambient Temperature	11/27/96			12/3/96	
• Change in Liner Material	7/22/97			7/10/97 (verbal)	
• Change in Screen Size	6/10/97	6/24/97	7/25/97		
• Placement of Materials on Top of Monolith	9/5/97 (verbal)			9/5/97 (verbal)	
• Sideslope/Perimeter Road					
• Tie-In	2/27/98			3/3/98	
Gamma and Radon Surveys	6/22/98 9/24/98			6/24/98	

DOCUMENT TITLE	SUBMITTAL TO EPA	EPA COMMENTS	RESPONSE TO COMMENTS	AGENCY APPROVAL	FINAL SUBMITTAL/ RESPONSE TO COMMENTS
• **Oil-Impacted Soils** • Testing Method	11/1/96	11/6/96	11/26/96	11/27/96	
• Bioremediation Work Plan for Rows 18-21 including additional information regarding material in Row 17	1/31/97	3/11/97	3/19/97	2/28/97 (verbal re first two tasks) 3/25/97 (with request for additional information)	4/11/97
• Notice of Contractor – Fluor Daniel GTI	2/27/97			3/10/97	3/11/97 (Statement of Qualifications)
• Proposal to Screen Oil-Impacted Soils	5/29/97				
• Withdrawal of Proposal – Intention to Dispose Off-Site	6/24/97				
• Proposal to Address Oil-Impacted Soils on Western Perimeter of Site (Bioremediation)	3/10/98 8/11/98	3/16/98 8/20/98	3/27/98 (Soil Boring Plan) 8/31/98	4/1/98	4/30/98 (Lab Results) 6/24/98

DOCUMENT TITLE	SUBMITTAL TO EPA	EPA COMMENTS	RESPONSE TO COMMENTS	AGENCY APPROVAL	FINAL SUBMITTAL/ RESPONSE TO COMMENTS
Miscellaneous					
• Proposal for Disposal of Sodium Metal	5/11/93	5/13/93		5/18/93	5/25/93 (Chemical Inventory)
• Geotechnical Data		7/12/96	7/26/96		
• Stop-Work Order		8/28/96 (verbal) 8/30/96	8/30/96	9/1/96 (verbal) 9/4/96 (partial lifting of Stop Work Order)	
• Notice of Violation		11/4/96			
• Settlement Offer for NOV	11/27/96	12/5/96			
• Stop-Work Order		1/22/97 (verbal) 1/29/97	1/28/97	3/20/97 (lifting of Stop-Work Order)	
• Notice of Violation		1/30/97 3/4/97	2/28/97		
• Notice of Lack of Progress on Remedial Action		3/31/97	4/4/97		
• Notice of Violation		6/30/97			
• Confirmation of Extension of Response	7/31/97		8/20/97		
• Notice of Violation		4/17/98	5/20/98		
Monthly Progress Reports Nos. 1 through 71	9/10/92 10/92 – 08/98				
Report No. 11		8/16/93	8/17/93		
Project Status Meeting Summaries	7/1/96 – 5/6/96				

Table 2: Summary of Materials Removed from Vicinity Properties

Vicinity Property Excavation Surveys	Estimated Material Quantity (loose cubic yards)[1]
Bannock Street shoulder	1,750
Centennial/RJR/Kroonberg	150
Dade/Pugliese	150
Danielson	2,550
Flanagan	400
Railroad property	3,650
Sachs Lawlor	50
Total	8,700
Stockpile Surveys	
Surveyed stockpile volume	7,800
Adjusted volume (per remedial design)[2]	8,200
Bannock Street (1997)	199
Total	**8,399 LCY**

Notes:

1 Soil volumes presented are estimates only as only rough surveys were made at each property. A detailed survey of the final stockpile was subsequently performed.

2 For purposes of the remedial design, the final stockpile volume was adjusted upwards by 5% to account for settlement and compaction.

Table 3: Excavation OCS Verification Results

Sample No.	Column	Row	Test Date	OCS (pCi/gm) [actual]	OCS (pCi/gm) [calculated]
SSVS 1	C9	R1	6/23/96	1.81	2.42
SSVS 1	C10	R1	6/23/96	0.97	0.97
SSVS 1	C11	R1	6/23/96	2.12	2.99
SSVS 1	C12	R1	6/23/96	1.84	2.47
SSVS 1	C13	R1	6/23/96	1.89	2.56
SSVS 1	C9	R2	6/23/96	1.61	2.05
SSVS 1	C10	R2	6/23/96	1.36	1.59
SSVS 1	C11	R2	6/23/96	0.96	0.96
SSVS 1	C12	R2	6/23/96	1.65	2.12
SSVS 1	C13	R2	6/23/96	1.06	1.04
SSVS 2	C4	R1	6/27/94	3.29	5.14
SSVS 2	C5	R1	6/27/94	2.29	3.30
SSVS 2	C6	R1	6/27/94	2.59	3.85
SSVS 2	C7	R1	6/27/94	3.30	5.16
SSVS 2	C8	R1	6/27/94	2.06	2.88
SSVS 2	C4	R2	6/27/94	4.04	6.52
SSVS 2	C5	R2	6/27/94	2.80	4.24
SSVS 2	C6	R2	6/27/94	1.94	2.66
SSVS 2	C7	R2	6/27/94	2.14	3.03
SSVS 2	C8	R2	6/27/94	1.75	2.31
SSVS 3	C1/C2	R1	6/6/94	2.51	3.70
SSVS 3	C3	R1	6/6/94	2.80	4.24
SSVS 3	C1/C2	R2	6/6/94	2.65	3.97
SSVS 3	C3	R2	6/6/94	2.04	2.84
SSVS 3	C1/C2	R3	6/6/94	2.59	3.85
SSVS 4	C13	R23	7/8/94	2.30	3.32
SSVS 4	C13	R24	7/8/94	2.35	3.41
SSVS 4	C13	R25	7/8/94	1.24	1.37
SSVS 4	C13	R26	7/8/94	0.22	0.22
SSVS 4	C13	R27	7/8/94	6.26	10.60
SSVS 4	C13	R28	7/8/94	2.12	2.99
SSVS 4	C13	R29	7/8/94	3.02	4.64
SSVS 5	C12	R23	7/11/94	2.66	3.98
SSVS 5	C12	R24	7/11/94	5.43	9.08
SSVS 5	C12	R25	7/11/94	4.30	7.00
SSVS 5	C12	R26	7/11/94	5.29	8.82
SSVS 5	C12	R27	7/11/94	6.68	10.42
SSVS 5	C12	R28	7/11/94	7.87	13.57
SSVS 5	C12	R29	7/11/94	1.94	2.66
SSVS 5	C11	R28	7/11/94	2.72	4.09
SSVS 5	C11	R29	7/11/94	2.09	2.93
SSVS 6	C11	R23	7/13/94	4.39	7.17
SSVS 6	C11	R24	7/13/94	4.65	7.65
SSVS 6	C11	R25	7/13/94	3.76	6.00
SSVS 6	C11	R26	7/13/94	7.39	12.68
SSVS 6	C11	R27	7/13/94	9.06	15.76
SSVS 6	C10	R23	7/13/94	0.14	0.14
SSVS 6	C10	R24	7/13/94	2.43	3.56

Table 3: Excavation OCS Verification Results

Sample No.	Column	Row	Test Date	OCS (pCi/gm) [actual]	OCS (pCi/gm) [calculated]
SSVS 6	C10	R25	7/13/94	4.89	8.09
SSVS 6	C10	R26	7/13/94	6.56	11.16
SSVS 7	C9	R24	7/14/94	4.14	6.70
SSVS 7	C9	R25	7/14/94	1.97	2.71
SSVS 7	C9	R26	7/14/94	5.62	9.43
SSVS 7	C9	R27	7/14/94	1.81	2.47
SSVS 7	C9	R28	7/14/94	2.56	3.80
SSVS 7	C9	R29	7/14/94	1.94	2.65
SSVS 7	C10	R27	7/14/94	10.16	17.78
SSVS 7	C10	R28	7/14/94	5.82	9.79
SSVS 7	C10	R29	7/14/94	3.04	4.68
SSVS 8	C9	R23	7/18/94	2.09	2.93
SSVS 8	C8	R23	7/18/94	5.71	9.59
SSVS 8	C8	R24	7/18/94	4.20	6.82
SSVS 8	C8	R25	7/18/94	3.20	4.98
SSVS 8	C8	R26	7/18/94	0.20	0.20
SSVS 8	C8	R27	7/18/94	0.91	0.91
SSVS 8	C8	R28	7/18/94	2.25	3.23
SSVS 8	C8	R29	7/18/94	3.67	5.84
SSVS 9	C7	R23	7/15/94	2.73	4.11
SSVS 9	C7	R24	7/15/94	5.93	10.00
SSVS 9	C7	R25	7/15/94	4.20	6.82
SSVS 9	C7	R26	7/15/94	6.62	11.27
SSVS 9	C7	R27	7/15/94	2.15	3.05
SSVS 9	C7	R28	7/15/94	4.80	7.92
SSVS 9	C7	R29	7/15/94	4.21	6.84
SSVS 10	C8	R3	7/20/94	2.06	2.88
SSVS 10	C9	R3	7/20/94	2.99	4.59
SSVS 10	C10	R3	7/20/94	1.82	2.44
SSVS 10	C11	R3	7/20/94	0.83	0.83
SSVS 10	C12	R3	7/20/94	1.45	1.76
SSVS 10	C13	R3	7/20/94	0.36	0.36
SSVS 11	C3	R3	7/27/94	3.00	4.61
SSVS 11	C4	R3	7/27/94	5.99	10.11
SSVS 11	C5	R3	7/27/94	5.66	9.50
SSVS 11	C6	R3	7/27/94	2.32	3.35
SSVS 11	C7	R3	7/27/94	3.25	5.07
SSVS 12	C10	R22	8/24/94	4.22	6.85
SSVS 12	C11	R22	8/24/94	1.69	2.79
SSVS 12	C12	R22	8/24/94	3.59	5.59
SSVS 12	C13	R22	8/24/94	3.31	5.18
SSVS 13	C6	R22	8/24/94	3.91	6.28
SSVS 13	C7	R22	8/24/94	3.47	5.47
SSVS 13	C8	R22	8/24/94	3.30	5.16
SSVS 13	C9	R22	8/24/94	2.08	2.91
SSVS 14	C2	R4	6/27/96	1.85	2.49
SSVS 14	C3	R4	6/27/96	2.27	3.26
SSVS 14	C4	R4	6/27/96	3.14	4.86

Table 3: Excavation OCS Verification Results

Sample No.	Column	Row	Test Date	OCS (pCi/gm) [actual]	OCS (pCi/gm) [calculated]
SSVS 14	C2	R5	6/27/96	0.50	0.50
SSVS 14	C3	R5	6/28/96	0.60	0.60
SSVS 14	C4	R5	6/28/96	1.21	1.31
SSVS 15	C11	R4	7/3/96	1.67	2.16
SSVS 15	C12	R4	7/3/96	1.52	1.84
SSVS 15	C13	R4	7/3/96	3.90	6.26
SSVS 15	C11	R5	7/3/96	8.55	14.82
SSVS 15	C12	R5	7/3/96	1.20	1.30
SSVS 15	C13	R5	7/3/96	1.90	2.58
SSVS 15	C11	R6	7/3/96	8.17	14.12
SSVS 15	C12	R6	7/3/96	0.55	0.55
SSVS 15	C13	R6	7/3/96	3.85	6.17
SSVS 15	C13	R7	7/5/96	0.59	0.59
SSVS 16	C9	R4	7/11/96	1.23	1.35
SSVS 16	C10	R4	7/11/96	2.03	2.83
SSVS 16	C9	R5	7/11/96	2.04	2.84
SSVS 16	C10	R5	7/11/96	2.61	3.89
SSVS 17	C5	R4	7/17/96	4.64	7.63
SSVS 17	C6	R4	7/17/96	4.98	8.25
SSVS 17	C7	R4	7/17/96	0.94	0.94
SSVS 17	C8	R4	7/17/96	0.68	0.68
SSVS 18	C5	R5	7/17/96	7.95	13.72
SSVS 18	C6	R5	7/17/96	1.84	2.47
SSVS 18	C7	R5	7/17/96	2.80	4.24
SSVS 18	C8	R5	7/17/96	4.10	6.63
SSVS 19	C7	R6	7/18/96	7.19	12.32
SSVS 19	C8	R6	7/18/96	3.54	5.60
SSVS 19	C9	R6	7/18/96	5.99	10.10
SSVS 19	C10	R6	7/18/96	2.69	4.04
SSVS 20	C9	R7	7/19/96	1.33	1.54
SSVS 20	C10	R7	7/19/96	1.63	2.09
SSVS 20	C11	R7	7/19/96	2.96	4.54
SSVS 20	C12	R7	7/19/96	1.70	2.22
SSVS 21	C4	R6	7/23/96	2.51	3.71
SSVS 21	C5	R6	7/23/96	1.42	1.70
SSVS 21	C6	R6	7/23/96	1.75	2.31
SSVS 22	C5	R7	7/25/96	0.74	0.74
SSVS 22	C6	R7	7/25/96	0.94	0.94
SSVS 22	C7	R7	7/25/96	0.71	0.71
SSVS 22	C8	R7	7/25/96	2.97	4.56
SSVS 23	C2	R6	7/26/96	4.84	7.99
SSVS 23	C3	R6	7/26/96	3.95	6.36
SSVS 23	C2	R7	7/26/96	1.62	2.07
SSVS 23	C3	R7	7/26/96	0.69	0.69
SSVS 23	C4	R7	7/26/96	1.30	1.48
SSVS 23	C3	R8	7/26/96	3.65	5.80
SSVS 24	C4	R8	7/29/96	0.92	0.92
SSVS 24	C5	R8	7/29/96	2.56	3.80

Table 3: Excavation OCS Verification Results

Sample No.	Column	Row	Test Date	OCS (pCi/gm) [actual]	OCS (pCi/gm) [calculated]
SSVS 24	C6	R8	7/29/96	0.68	0.68
SSVS 24	C7	R8	7/29/96	1.50	1.85
SSVS 25	C8	R8	8/2/96	2.79	4.22
SSVS 25	C9	R8	8/5/96	0.22	0.22
SSVS 25	C10	R8	8/13/96	7.68	13.22
SSVS 25	C11	R8	8/13/96	4.49	7.35
SSVS 25	C12	R8	8/13/96	3.17	4.92
SSVS 25	C13	R8	8/13/96	1.64	2.11
SSVS 26	C3/C4	R9	8/24/96	1.75	2.31
SSVS 26	C5	R9	8/24/96	2.54	3.76
SSVS 26	C6	R9	8/24/96	2.22	3.17
SSVS 26	C7	R9	8/24/96	0.96	0.96
SSVS 26	C3/C4	R10	8/24/96	1.31	1.50
SSVS 27	C8	R9	9/3/96	1.88	2.54
SSVS 27	C9	R9	9/4/96	1.55	1.94
SSVS 27	C10	R9	9/4/96	6.06	10.24
SSVS 27	C11	R9	9/4/96	6.35	10.77
SSVS 27	C12	R9	9/4/96	1.58	1.99
SSVS 27	C13	R9	9/4/96	4.24	6.89
SSVS 28	C5	R10	9/19/96	6.16	10.42
SSVS 28	C6	R10	9/19/96	2.79	4.22
SSVS 28	C7	R10	9/25/96	0.24	0.24
SSVS 28	C8	R10	9/25/96	1.79	2.38
SSVS 29	C9	R10	9/29/96	1.87	2.53
SSVS 29	C10	R10	9/29/96	2.01	2.79
SSVS 29	C11	R10	9/29/96	5.32	8.88
SSVS 29	C12	R10	9/29/96	5.90	9.95
SSVS 29	C13	R10	9/29/96	3.84	6.16
SSVS 30	C10	R11	10/5/96	3.66	5.82
SSVS 30	C11	R11	10/5/96	0.82	0.60
SSVS 30	C12	R11	10/5/96	4.31	7.02
SSVS 30	C13	R11	10/5/96	5.60	9.39
SSVS 31	C4	R11	10/5/96	2.75	4.15
SSVS 31	C5	R11	10/7/96	3.25	5.07
SSVS 31	C6	R11	10/8/96	1.17	1.24
SSVS 31	C7	R11	10/9/96	1.96	2.70
SSVS 31	C8	R11	10/10/96	1.61	2.05
SSVS 31	C9	R11	10/10/96	0.96	0.96
SSVS 31	C4	R12	10/5/96	2.16	3.06
SSVS 32	C5	R12	10/19/96	1.67	2.16
SSVS 32	C6	R12	10/19/96	1.14	1.14
SSVS 32	C7	R12	10/19/96	3.27	5.11
SSVS 32	C8	R12	10/21/96	1.17	1.24
SSVS 33	C9	R12	10/23/96	0.65	0.65
SSVS 33	C10	R12	10/23/96	0.94	0.94
SSVS 33	C11	R12	10/23/96	1.23	1.35
SSVS 33	C12	R12	10/23/96	1.77	2.35
SSVS 33	C13	R12	10/23/96	2.45	3.60

Table 3: Excavation OCS Verification Results

Sample No.	Column	Row	Test Date	OCS (pCi/gm) [actual]	OCS (pCi/gm) [calculated]
SSVS 34	C4	R13	11/4/96	3.06	4.72
SSVS 34	C5	R13	11/7/96	1.77	2.34
SSVS 34	C6	R13	11/8/96	5.92	9.98
SSVS 34	C7	R13	11/8/96	1.87	2.53
SSVS 34	C8	R13	11/8/96	1.10	1.10
SSVS 35	C9	R13	11/9/96	1.01	1.01
SSVS 35	C10	R13	11/9/96	0.77	0.77
SSVS 35	C11	R13	11/9/96	2.47	3.63
SSVS 35	C12	R13	11/9/96	1.97	2.72
SSVS 35	C13	R13	11/9/96	1.66	2.14
SSVS 36	C4	R14	11/19/96	4.67	7.68
SSVS 36	C5	R14	11/20/96	2.71	4.08
SSVS 36	C6	R14	11/20/96	5.12	8.51
SSVS 36	C7	R14	11/20/96	3.37	5.29
SSVS 36	C4	R15	11/19/96	5.77	9.71
SSVS 37	C8	R14	11/21/96	3.21	4.99
SSVS 37	C9	R14	11/22/96	3.14	4.86
SSVS 37	C10	R14	11/22/96	3.70	5.89
SSVS 37	C11	R14	11/22/96	1.83	2.46
SSVS 37	C12	R14	11/22/96	3.24	5.05
SSVS 37	C13	R14	11/22/96	3.69	5.88
SSVS 38	C5	R15	11/30/96	2.89	4.41
SSVS 38	C6	R15	11/30/96	3.66	5.82
SSVS 38	C7	R15	11/30/96	2.37	4.36
SSVS 38	C8	R15	11/30/96	1.86	2.51
SSVS 38	C9	R15	11/30/96	0.48	0.48
SSVS 38	C10	R15	11/30/96	1.30	1.48
SSVS 38	C11	R15	11/30/96	3.98	6.41
SSVS 38	C12	R15	11/30/96	3.56	5.64
SSVS 38	C13	R15	11/30/96	0.72	0.72
SSVS 39	C4	R16	12/9/96	3.81	6.10
SSVS 39	C5	R16	12/6/96	3.54	5.60
SSVS 39	C6	R16	12/6/96	5.29	8.82
SSVS 39	C7	R16	12/6/96	1.79	2.38
SSVS 39	C4	R17	12/6/96	3.32	5.20
SSVS 40	C8	R16	12/11/96	4.64	7.63
SSVS 40	C9	R16	12/12/96	1.55	1.94
SSVS 40	C10	R16	12/12/96	2.81	4.26
SSVS 40	C11	R16	12/12/96	2.15	3.04
SSVS 40	C12	R16	12/12/96	1.59	2.02
SSVS 40	C13	R16	12/11/96	3.33	5.22
SSVS 41	C5	R17	12/16/96	3.29	5.14
SSVS 41	C6	R17	12/16/96	2.81	4.26
SSVS 41	C7	R17	12/16/96	4.80	8.21
SSVS 41	C8	R17	12/16/96	2.91	4.44
SSVS 42	C9	R17	12/18/96	2.72	4.09
SSVS 42	C10	R17	12/18/96	2.68	4.02
SSVS 42	C11	R17	12/18/96	2.87	4.37

Table 3: Excavation OCS Verification Results

Sample No.	Column	Row	Test Date	OCS (pCi/gm) [actual]	OCS (pCi/gm) [calculated]
SSVS 42	C12	R17	12/18/96	2.03	2.83
SSVS 42	C13	R17	12/18/96	2.94	4.50
SSVS 43	C6	R18	1/9/97	7.67	13.23
SSVS 43	C7	R18	1/9/97	9.15	15.92
SSVS 43	C8	R18	1/9/97	3.18	4.94
SSVS 43	C9	R18	1/9/97	2.30	3.32
SSVS 43	C10	R18	1/9/97	2.41	3.52
SSVS 43	C11	R18	1/8/97	2.92	4.46
SSVS 43	C12	R18	1/8/97	3.70	5.89
SSVS 43	C13	R18	12/30/96	2.11	2.97
SSVS 44	C5	R18	1/17/97	4.56	7.48
SSVS 44	C5	R19	1/17/97	6.46	10.98
SSVS 44	C5	R20	1/17/97	9.35	16.29
SSVS 44	C5	R21	1/17/97	2.83	4.30
SSVS 44	C6	R19	1/18/97	8.98	15.61
SSVS 44	C6	R20	1/18/97	3.61	5.73
SSVS 44	C6	R21	1/18/97	3.14	4.84
SSVS 45	C7	R19	1/22/97	2.60	3.87
SSVS 45	C8	R19	1/18/97	1.09	1.10
SSVS 45	C9	R19	1/22/97	2.13	3.01
SSVS 45	C10	R19	1/23/97	3.39	5.33
SSVS 45	C11	R19	1/23/97	3.84	6.16
SSVS 45	C12	R19	1/23/97	3.77	6.03
SSVS 45	C13	R19	1/23/97	8.78	15.25
SSVS 46	C11	R20	1/26/97	3.11	4.81
SSVS 46	C12	R20	1/24/96	1.16	1.22
SSVS 46	C13	R20	1/26/98	5.59	9.38
SSVS 46	C11	R21	1/26/98	5.31	8.86
SSVS 46	C12	R21	1/26/98	3.16	4.79
SSVS 46	C13	R21	1/26/98	3.15	4.89
SSVS 47	C7	R20	1/29/97	7.39	12.69
SSVS 47	C8	R20	1/29/97	3.04	4.68
SSVS 47	C9	R20	1/29/97	2.57	3.81
SSVS 47	C10	R20	1/27/97	1.40	1.40
SSVS 47	C7	R21	1/29/97	1.84	2.47
SSVS 47	C8	R21	1/29/97	3.55	5.62
SSVS 47	C9	R21	1/29/97	4.66	7.66
SSVS 47	C10	R21	1/27/97	2.40	3.50
R22C6	C6	R22	8/26/97	8.31	14.38
R22C7	C7	R22	8/26/97	8.51	14.75
R22C8	C8	R22	8/26/97	8.57	14.86
R22C9	C9	R22	8/26/97	5.58	9.36
R22C10	C10	R22	8/26/97	7.69	13.24
R22C11	C11	R22	8/26/97	9.45	16.48
R22C12	C12	R22	8/26/97	9.07	15.78
R22C6-12	C6-12	R22	8/26/97	8.15	14.08
R23C7	C7	R23	9/12/97	7.08	12.12
R23C8	C8	R23	9/12/97	6.67	11.36

Table 3: Excavation OCS Verification Results

Sample No.	Column	Row	Test Date	OCS (pCi/gm) [actual]	OCS (pCi/gm) [calculated]
R23C9	C9	R23	9/15/97	9.33	16.26
R23C10	C10	R23	9/15/97	7.16	12.26
R23C11	C11	R23	9/15/97	8.39	14.53
R23C12	C12	R23	9/15/97	8.67	15.04
R23C7-12	C7-12	R23	9/15/97	7.88	13.59
R24C7	C7	R24	9/12/97	9.41	16.4
R24C8	C8	R24	9/12/97	9.43	16.44
R24C9	C9	R24	9/15/97	8.15	14.09
R24C10	C10	R24	9/15/97	7.09	12.14
R24C11	C11	R24	9/15/97	8.29	14.34
R24C12	C12	R24	9/15/97	9.41	16.4
R24C7-12	C7-12	R24	9/16/97	9.46	16.5

Notes:
OCS = Opposed Crystal System gamma radiation counter
pCi/gm = picoCuries per gram
[1]Actual = measured concentration
[2]Calculated=emperical correction factor for both moisture and radium-radon disequilibrium
Calculated CS = (1.84*Actual·OCS)-0.91
Based on Chapter 4 Field Assessment Procedures Manual (FAPM)

Table 4: Excavation Confirmation Sampling - Metals

Sample No.	Verification Samples Creating Composite	Date	Time	Total Lead (mg/kg)	Total Arsenic (mg/kg)	Total Selenium (mg/kg)	TCLP Lead (mg/l)	TCLP Arsenic (mg/l)	TCLP Selenium (mg/l)
	Acceptance criteria	-	-	540(1)	160(1)	490(1)	5.0(2)	5.0(2)	1.0(2)
SSVS 1	C9/R1; C10/R1; C11/R1; C12/R1; C13/R1; C9/R2; C10/R2; C11/R2; C12/R2; C13/R2	06/24/96	12:40	17	1.3	<1	<0.02	<0.03	<0.03
SSVS 2	C4/R1; C5/R1; C6/R1; C7/R1; C8/R1; C4/R2; C5/R2; C6/R2; C7/R2; C8/R2	07/05/94	11:05	59	<6.0	10	<0.05	<0.06	<0.1
SSVS 3	C1/R1; C2/R1; C3/R1; C1/R2; C2/R2; C2/R3; C3/R2; C1/R3	06/30/96	07:30	3	17	20	<0.05	<0.06	<0.1
SSVS 4	C13/R23; C13/R24; C13/R25; C13/R26; C13/R27; C13/R28; C13/R29	07/11/94	08:45	26	<6	<10	<0.05	<0.06	<0.1
SSVS 5	C12/R23; C12/R24; C12/R25; C12/R26; C12/R27; C12/R28; C12/R29; C11/R28; C11/R29	07/14/94	14:40	35	<6	12	<0.05	<0.06	<0.1
SSVS 6	C11/R23; C11/R24; C11/R25; C11/R26; C11/R27; C10/R23; C10/R24; C10/R25; C10/R26	07/15/94	13:40	32	<6	24	<0.05	<0.06	<0.1
SSVS 7	C9/R24; C9/R25; C9/R26; C9/R27; C9/R28; C9/R29; C10/R27; C10/R28; C10R29	07/18/97	09:55	26	<6	24	<0.05	<0.06	<0.1
SSVS 8	C9/R23; C8/R23; C8/R24; C8/R25; C8/R26; C8/R27; C8/R28; C8/R29	07/25/94	08:20	20	8	12	<0.05	<0.06	<0.1
SSVS 9	C7/R23; C7/R24; C7/R25; C7/R26; C7/R27; C7/R28; C7/R29	07/25/94	08:20	39	8	<10	<0.05	<0.06	<0.1
SSVS 10	C8/R3; C9/R3; C10/R3; C11/R3; C12/R3; C13/R3	07/27/94	08:30	7	<6	<10	<0.05	<0.06	<0.1
SSVS 11	C3/R3; C4/R3; C5/R3; C6/R3; C7/R3	07/27/94	08:40	46	17	14	<0.05	<0.06	<0.1
SSVS 12	C7/R22; C8/R22; C9/R22; C10/R22; C11/R22; C12/R22; C13/R22	09/01/94	12:45	31	25	<10	N/A	N/A	N/A
SSVS 13	C5/R22; C6/R22; C7/R22; C8/R22; C9/R22	09/07/94	10:20	7	<6	<10	N/A	N/A	N/A
SSVS 14	C9/R4; C10/R4; C9/R5; C10/R5	06/29/96	09:00	64	55	16	<0.1	<0.1	0.1
SSVS 15	C11/R4; C12/R4; C13/R4; C11/R5; C12/R5; C13/R5; C11/R6; C12/R6; C13/R6; C13/R7	07/08/96	14:00	18	27	<5	<0.1	<0.1	<0.1
SSVS 16	C9/R4; C10/R4; C9/R5; C10/R5	07/16/96	09:00	10	26	<5	<0.1	<0.1	<0.1
SSVS 17	C5/R4; C6/R4; C7/R4; C8/R4	07/17/96	16:00	21	32	6	<0.1	<0.1	<0.1
SSVS 18	C5/R5; C6/R5; C7/R5; C8/R5	07/17/96	14:30	15	32	<5	<0.1	<0.1	<0.1
SSVS 19	C7/R6; C8/R6; C9/R6; C10/R6	07/19/96	09:15	12	23	<5	<0.1	<0.1	<0.1
SSVS 20	C9/R7; C10/R7; C11/R7; C12/R7	07/22/96	07:37	12	28	<5	<0.1	<0.1	<0.1
SSVS 21	C4/R6; C5/R6; C6/R6	07/23/96	13:00	18	42	<5	<0.1	<0.1	<0.1
SSVS-22	C5/R7; C6/R7; C7/R7; C8/R7	07/26/96	11:00	12	25	<5	<0.1	<0.1	<0.1
SSVS 23	C2/R6; C3/R6; C2/R7; C3/R7; C4/R7; C3/R8	07/27/96	15:30	31	34	9	<0.1	<0.1	<0.1
SSVS 24	C4/R8; C5/R8; C6/R8; C7/R8	07/29/96	15:45	14	33	<5	<0.1	<0.1	<0.1
SSVS 25	C8.R8; C9/R8; C10/R8; C11/R8; C12/R8; C13/R8	08/14/96	11:00	17	29	<5	<0.1	<0.1	<0.1
SSVS 26	C3/R9; C4/R9; C5/R9; C6/R9; C7/R9; C3/R10; C4/R10	08/26/96	12:00	11	46	<5	<0.1	<0.1	<0.1
SSVS 27	C8/R9; C9/R9; C10/R9; C11/R9; C12/R9; C13/R9	09/05/96	08:30	14	25	<5	<0.1	<0.1	<0.1
SSVS 28	C5/R10; C6/R10; C7/R10; C8/R10	09/26/96	12:00	16	20	<5	<0.1	<0.1	<0.1
SSVS 29	C9/R10; C10/R10; C11/R10; C12/R10; C13/R10	09/30/96	07:00	15	12	<5	<0.1	<0.1	<0.1
SSVS 30	C10/R11; C11/R11; C12/R11; C13/R11	10/07/96	08:00	36	<5	<5	<0.1	<1.0	<0.1
SSVS 31	C4/R11; C5/R11; C6/R11; C7/R11; C8/R11; C9/R11; C4/R12	10/10/96	13:30	12	16	5	<0.1	<0.1	<0.1
SSVS 32	C5/R12; C6/R12; C7/R12; C8/R12	10/21/96	09:30	11	<5	12	<0.1	<0.5	<0.1
SSVS 33	C9/R12; C10/R12; C11/R12; C12/R12; C13/R12	10/24/96	07:15	39	7	<5	<0.1	<0.1	<0.1
SSVS 34	C4/R13; C5/R13; C6/R13; C7/R13; C8/R13	11/08/96	12:00	22	27	7	<0.1	<0.1	<0.1
SSVS 35	C9/R13; C10/R13; C11/R13; C12/R13; C13/R13	11/11/96	08:00	19	15	<5	<0.1	<0.5	<0.1
SSVS 36	C4/R14; C5/R14; C6/R14; C7/R14; C4/R15	11/20/96	12:00	27	18	28	<0.1	<0.1	0.3
SSVS 37	C8/R14; C9/R14; C10/R14; C11/R14; C12/R14; C13/R14	11/22/96	13:00	26	38	<5	<0.1	<0.1	<0.1

Table 4: Excavation Confirmation Sampling - Metals

Sample No.	Verification Samples Creating Composite	Date	Time	Total Lead (mg/kg)	Total Arsenic (mg/kg)	Total Selenium (mg/kg)	TCLP Lead (mg/l)	TCLP Arsenic (mg/l)	TCLP Selenium (mg/l)
SSVS 38	C5/R15; C6/R15; C7/R15; C8/R15; C9/R15; C10/R15; C11/R15; C12/R15; C13/R15	11/30/96	16:00	33	23	<5	<0.1	<0.1	<0.1
SSVS 39	C4/R16; C5/R16; C6/R16; C7/R16; C4/R17	12/09/96	13:30	16	19	8	<0.1	<0.1	<0.1
SSVS 40	C8/R16; C9/R16; C10/R16; C11/R16; C12/R16; C13/R16	12/12/96	14:00	46	60	10	<0.1	<0.1	<0.1
SSVS 41	C5/R17; C6/R17; C7/R17; C8/R17	12/16/96	10:15	36	18	8	<0.1	<0.1	<0.1
SSVS 42	C9/R17; C10/R17; C11/R17; C12/R17; C13/R17	12/18/96	15:30	14	24	<5	<0.1	<0.1	<0.1
SSVS 43	C6/R18; C7/R18; C8/R18; C9/R18; C10/R18; C11/R18; C12/R18; C13/R18	01/20/97	07:20	34	22	6	<0.1	<0.1	<0.1
SSVS 44	C5/R18; C5/R19; C5/R20; C15/R21; C6/R19; C6/R20; C6/R21	01/24/97	08:30	220	29	7	<0.1	<0.1	<0.1
SSVS 45	C7/R19; C8/R19; C9/R19; C10/R19; C11/R19; C12/R19; C13/R19	01/27/97	10:00	49	20	<5	<0.1	<0.1	<0.1
SSVS 46	C11/R21; C12/R21; C13/R21; C11/R20; C12/R20; C13/R20	01/29/97	10:30	53	20	<5	<0.1	<0.1	<0.1
SSVS 47	C7/R20; C8/R20; C9/R20; C10/R20; C7/R21; C8/R21; C9/R21; C10/R21	10/24/96	07:15	65	34	8	<0.1	<0.1	<0.1
	R22C6-12	8/27/97		33	49	<5			
	R23C7-12	9/15/97		14	<25	<5			
	R24C7-12	9/16/97		20	<25	<5			
	Haul Road:A-J	10/9/97		29	8	<5			
	Haul Road: K-T	10/9/97		28	7	7			
	Haul Road: U-Z, AA-DD	10/9/97		62	10	<5			
	Haul Road: EE-LL	10/9/97		36	9	<5			
	Haul Road: KK*-LL*,TT-WW	11/14/97		26	<5	5			
	Haul Road: MM-SS	11/11/97		23	14	<5			

Notes:
* Re-test
mg/kg = milligrams per kilogram
mg/l = milligrams per liter
TCLP = Toxic Characteristic Leaching Procedure
< means less than the reported value
Blank indicates that the test was not performed
(1) Acceptance Criteria from Table 9.2 of the Record of Decision, Analytical Method 6010
(2) Acceptance Criteria based on RCRA maximum concentrations (40 CFR 261.24), Analytical Methods 1311 and 6010

Table 5: Excavation Confirmation Sampling - Radionuclides

Sample No.	Verification Samples Creating Composite	Date	Time	Thorium-228 Activity (pCi/g)	Thorium-230 Activity (pCi/g)	Thorium-232 Activity (pCi/g)	Total Uraninum (pCi/g)	Radium-226 Activity (pCi/g)
	Acceptance Criteria	-	-	NA	42.0(1)	NA	75.0(1)	16.5(1)
SSVS 1	C9/R1; C10/R1; C11/R1; C12/R1; C13/R1; C9/R2; C10/R2; C11/R2; C12/R2; C13/R2	06/24/96	12:40	0.89	3.35	0.98	2.02	1.14(2)
SSVS 2	C4/R1; C5/R1; C6/R1; C7/R1; C8/R1; C4/R2; C5/R2; C6/R2; C7/R2; C8/R2	07/05/94	11:05	0.79	4.62	1.12	6.45	1.88(2)
SSVS 3	C1/R1; C2/R1; C3/R1; C1/R2; C2/R2; C2/R3; C3/R2; C1/R3	06/30/96	07:30	0.71	4.82	0.94	6.03	1.86(2)
SSVS 4	C13/R23; C13/R24; C13/R25; C13/R26; C13/R27; C13/R28; C13/R29	07/11/94	08:45	1.11	6.50	1.14	18.08	0.80
SSVS 5	C12/R23; C12/R24; C12/R25; C12/R26; C12/R27; C12/R28; C12/R29; C11/R28; C11/R29	07/14/94	14:40	1.52	13.81	1.81	24.91	<0.37
SSVS 6	C11/R23; C11/R24; C11/R25; C11/R26; C11/R27; C10/R23; C10/R24; C10/R25; C10/R26	07/15/94	13:40	1.25	11.91	1.08	9.68	2.09
SSVS 7	C9/R24; C9/R25; C9/R26; C9/R27; C9/R28; C9/R29; C10/R27; C10/R28; C10R29	07/18/97	09:55	0.70	15.54	0.95	18.66	<0.42
SSVS 8	C9/R23; C8/R23; C8/R24; C8/R25; C8/R26; C8/R27; C8/R28; C8/R29	07/25/94	08:20	1.16	7.95	0.61	17.69	1.33
SSVS 9	C7/R23; C7/R24; C7/R25; C7/R26; C7/R27; C7/R28; C7/R29	07/25/94	08:20	1.05	7.71	1.05	21.85	<0.42
SSVS 10	C8/R3; C9/R3; C10/R3; C11/R3; C12/R3; C13/R3	07/27/94	08:30	0.92	3.95	1.07	2.07	2.09
SSVS 11	C3/R3; C4/R3; C5/R3; C6/R3; C7/R3	07/27/94	08:40	1.25	8.41	1.20	7.31	0.73
SSVS 12	C7/R22; C8/R22; C9/R22; C10/R22; C11/R22; C12/R22; C13/R22	09/01/94	12:45	1.02	4.21	1.43	8.69	2.78(2)
SSVS 13	C5/R22; C6/R22; C7/R22; C8/R22; C9/R22	09/07/94	10:20	0.87	1.36	0.70	2.49	0.83(2)
SSVS 14	C9/R4; C10/R4; C9/R5; C10/R5	06/29/96	09:00	1.40	5.10	1.30	7.70	1.80
SSVS 15	C11/R4; C12/R4; C13/R4; C11/R5; C12/R5; C13/R5; C11/R6; C12/R6; C13/R6; C13/R7	07/08/96	14:00	1.40	7.90	1.30	3.64	2.90
SSVS 16	C9/R4; C10/R4; C9/R5; C10/R5	07/16/96	09:00	1.00	13.00	1.10	4.06	5.00
SSVS 17	C5/R4; C6/R4; C7/R4; C8/R4	07/17/96	16:00	1.30	14.00	1.40	4.34	3.80
SSVS 18	C5/R5; C6/R5; C7/R5; C8/R5	07/17/96	14:30	1.20	14.00	1.20	7.70	6.20
SSVS 19	C7/R6; C8/R6; C9/R6; C10/R6	07/19/96	09:15	1.20	15.00	1.50	7.00	4.90
SSVS 20	C9/R7; C10/R7; C11/R7; C12/R7	07/22/96	07:37	0.80	7.20	1.00	2.80	4.30
SSVS 21	C4/R6; C5/R6; C6/R6	07/23/96	13:00	0.60	0.90	0.70	2.31	1.70
SSVS-22	C5/R7; C6/R7; C7/R7; C8/R7	07/26/96	11:00	1.50	3.80	1.60	1.82	1.10
SSVS 23	C2/R6; C3/R6; C2/R7; C3/R7; C4/R7; C3/R8	07/27/96	15:30	1.60	6.80	1.50	11.90	2.90
SSVS 24	C4/R8; C5/R8; C6/R8; C7/R8	07/29/96	15:45	1.30	2.10	1.70	3.85	1.00
SSVS 25	C8.R8; C9/R8; C10/R8; C11/R8; C12/R8; C13/R8	08/14/96	11:00	1.50	14.00	2.00	4.48	5.30
SSVS 26	C3/R9; C4/R9; C5/R9; C6/R9; C7/R9; C3/R10; C4/R10	08/26/96	12:00	1.70	3.80	1.70	5.74	2.20
SSVS 27	C8/R9; C9/R9; C10/R9; C11/R9; C12/R9; C13/R9	09/05/96	08:30	1.40	11.00	1.70	9.10	6.10
SSVS 28	C5/R10; C6/R10; C7/R10; C8/R10	09/26/96	12:00	1.40	6.50	1.60	10.50	3.00
SSVS 29	C9/R10; C10/R10; C11/R10; C12/R10; C13/R10	09/30/96	07:00	1.00	13.00	0.90	30.80	12.00
SSVS 30	C10/R11; C11/R11; C12/R11; C13/R11	10/07/96	08:00	1.20	40.00	1.80	37.80	4.50
SSVS 31	C4/R11; C5/R11; C6/R11; C7/R11; C8/R11; C9/R11; C4/R12	10/10/96	13:30	1.00	4.70	1.10	7.00	2.50
SSVS 32	C5/R12; C6/R12; C7/R12; C8/R12	10/21/96	09:30	1.10	15.00	1.10	49.70	3.30
SSVS 33	C9/R12; C10/R12; C11/R12; C12/R12; C13/R12	10/24/96	07:15	1.00	12.00	1.50	12.60	1.70
SSVS 34	C4/R13; C5/R13; C6/R13; C7/R13; C8/R13	11/08/96	12:00	1.10	20.00	0.30	28.70	3.60
SSVS 35	C9/R13; C10/R13; C11/R13; C12/R13; C13/R13	11/11/96	08:00	1.10	35.00	1.50	25.20	4.70
SSVS 36	C4/R14; C5/R14; C6/R14; C7/R14; C4/R15	11/20/96	12:00	1.20	21.00	1.60	42.70	3.60
SSVS 37	C8/R14; C9/R14; C10/R14; C11/R14; C12/R14; C13/R14	11/22/96	13:00	1.50	6.00	1.20	5.32	3.10
SSVS 38	C5/R15; C6/R15; C7/R15; C8/R15; C9/R15; C10/R15; C11/R15; C12/R15; C13/R15	11/30/96	16:00	1.60	7.10	1.50	14.00	1.80
SSVS 39	C4/R16; C5/R16; C6/R16; C7/R16; C4/R17	12/09/96	13:30	3.30	20.00	3.30	9.80	3.50
SSVS 40	C8/R16; C9/R16; C10/R16; C11/R16; C12/R16; C13/R16	12/12/96	14:00	1.10	5.70	1.40	35.70	3.40
SSVS 41	C5/R17; C6/R17; C7/R17; C8/R17	12/16/96	10:15	1.10	5.20	1.40	16.10	2.70
SSVS 42	C9/R17; C10/R17; C11/R17; C12/R17; C13/R17	12/18/96	15:30	1.50	2.20	1.40	4.48	2.40
SSVS 43	C6/R18; C7/R18; C8/R18; C9/R18; C10/R18; C11/R18; C12/R18; C13/R18	01/20/97	07:20	1.00	17.00	1.70	21.70	8.70
SSVS 44	C5/R18; C5/R19; C5/R20; C15/R21; C6/R19; C6/R20; C6/R21	01/24/97	08:30	1.50	7.70	1.20	22.40	4.70

Table 5: Excavation Confirmation Sampling - Radionuclides

Sample No.	Verification Samples Creating Composite	Date	Time	Thorium-228 Activity (pCi/g)	Thorium-230 Activity (pCi/g)	Thorium-232 Activity (pCi/g)	Total Uraninum (pCi/g)	Radium-226 Activity (pCi/g)
SSVS 45	C7/R19; C8/R19; C9/R19; C10/R19; C11/R19; C12/R19; C13/R19	01/27/97	10:00	1.40	22.00	0.10	33.60	6.30
SSVS 46	C11/R21; C12/R21; C13/R21; C11/R20; C12/R20; C13/R20	01/29/97	10:30	1.40	14.00	1.20	14.00	4.50
SSVS 47	C7/R20; C8/R20; C9/R20; C10/R20; C7/R21; C8/R21; C9/R21; C10/R21	10/24/96	07:15	1.60	8.70	1.70	11.90	3.60
	R22C6-12	8/27/97			12 +/- 1.7		15	4.8 +/- 1.5
	R23C7-12	9/15/97			6.2 +/- 0.9		7.1	3.5 +/- 1.1
	R24C7-12	9/16/97			12 +/- 1.7		12	4.9 +/- 1.5
	Haul Road:A-J	10/9/97			15 +/- 2.0		15	7.2 +/- 2.2
	Haul Road: K-T	10/9/97			18 +/- 2.6		28	7.4 +/- 2.3
	Haul Road: U-Z, AA-DD	10/9/97			19 +/- 2.6		23	8.8 +/- 2.7
	Haul Road: EE-LL	10/9/97			27 +/- 3.6		35	11 +/- 3.4
	Haul Road: MM	11/11/97						7.8 +/- 2.5
	Haul Road: NN	11/11/97						7.5 +/- 2.4
	Haul Road: OO	11/11/97						7.1 +/- 2.3
	Haul Road: PP	11/11/97						3.7 +/- 1.3
	Haul Road: QQ	11/11/97						5.0 +/- 1.7
	Haul Road: RR	11/11/97						6.6 +/- 2.1
	Haul Road: SS	11/11/97						8.9 +/- 2.9
	Haul Road: F**	11/11/97						8.7 +/- 2.8
	Haul Road: VV	11/11/97						16 +/- 5.1
	Haul Road: MM-SS	11/11/97			13 +/- 1.5		14	4.8 +/- 1.5
	Haul Road: KK*	11/14/97						1.7 +/- 0.9
	Haul Road: LL*	11/14/97						1.6 +/- 1.0
	Haul Road: TT	11/14/97						3.6 +/- 1.3
	Haul Road: UU	11/14/97						5.4 +/- 1.8
	Haul Road: WW	11/14/97						8.4 +/- 2.8
	Haul Road: KK*-LL*,TT-WW	11/14/97			12 +/- 1.3		12	4.9 +/- 1.5

Notes:

(1) Acceptance Criteria from Table 9-2 of Record of Decision, Analytical Method 901.1 (Modified)

(2) Radium analyzed as Bismuth-214 by gamma spectrometry

pCi/g = picocuries per gram

NA - not applicable

* Re-test

** Re-test of re-test

< = less than the reported value

Blank indicates that the test was not performed

Table 6: Sandcone Tests for Foundation Compaction

Sand Cone Test No. [1]	Date	Row No.	Col No.	Moisture Content (%)	Dry Density (PCF) [2]	Maximum Dry Density (PCF)	Percent Compaction (%) [3]	Notes
FND-01-6/29/96	06/29/96	2	12	5.6	136.8	130.0	105.2%	PASS
FND-02-6/29/96	06/29/96	1	8	7.1	123.3	130.0	94.9%	PASS
FND-01-7/25/96-0645	07/25/96	5	6	12.0	118.5	125.4	94.5%	PASS
FND-02-7/25/96-0825	07/25/96	4	10	8.0	124.2	NA[4]	NA[4]	PASS
FND-01-8/6/96-1115	08/06/96	6	6	10.8	127.1	131.3	96.8%	PASS
FND-01-8/16/96-0910	08/16/96	7	11	4.4	137.4	NA[4]	NA[4]	PASS
FND-01-9/10/96-0950	09/10/96	7	8	8.4	110.5	125.4	94.5%	PASS
FND-02-9/10/96-1600	09/10/96	7	8	7.6	124.7	132.0	94.5%	PASS
FND-01-9/14/96-1256	09/14/96	7	4	9.4	124.4	132.0	94.2%	PASS
FND-01-9/23/96-0908	09/23/96	9	11	8.6	125.7	131.7	95.4%	PASS
FND-02-9/23/96-0958	09/23/96	8	6	10.7	116.7	129.5	90.1%	PASS
FND-01-8/24/96-0845	10/08/96	10	9	11.2	122.9	129.5	94.9%	PASS
FND-01-11/11/96-0807	11/01/96	12	7	10.8	120.7	129.6	93.1%	PASS
FND-01-12/3/96-0758	12/03/96	14	10	11.8	116.9	133.5	87.6%	Recompacted and retested[5]
FND-01-12/3/96-0758	12/04/96	14	10	23.2	103.5	133.5	77.5%	Recompacted and retested
FND-02-12/3/96-0758	12/04/96	14	10	7.6	121.7	133.5	91.2%	PASS, retest of FND-01-12/3/96-0758
FLL-01-11/19/96-0857[6]	12/04/96	14	6	5.9	132.4	137.7	96.2%	PASS
FLL-01-12/9/96-1540[6]	12/09/96	15	12	7.7	125.7	137.5	91.4%	PASS
FLL-01-12/13/96-1200[6]	12/11/96	15	4	14.2	115.3	125.4	91.9%	PASS
FND-01-1/9/97-1445	01/09/97	16	11	6.1	131.0	134.5	97.4%	PASS
FD0528-1	5/28/97	19	7	16.1	90.4	97.7	92.5	PASS
FD0528-2	5/28/97	9	6	21.8	97.4	97.7	99.7	PASS
FD0529-1	5/29/97	18	8	16.0	95.8	97.7	98.1	PASS
FD0529-2	5/29/97	19	6	19.2	97.3	97.7	99.6	PASS
FD0529-3	5/29/97	19	9	16.7	96.8	97.9	99.0	PASS
FD0529-4	5/29/97	18	9	15.0	107.9	131.0	82.3	Recompacted and retested
FD0530-1	5/30/97	19	8	17.9	91.0	97.7	93.1	PASS
FD0530-2	5/30/97	18	9	11.2	112.0	125.0	89.6	Retest of FD0529-4
FD0530-3	5/30/97	18	9	12.9	103.9	125.0	83.1	Retest of FD0530-2
FD0530-4	5/30/97	18	9	18.6	104.5	125.0	83.6	Retest of FD0530-3
FD0602-1	6/2/97	18	9	15.5	113.7	125.0	91.0	PASS, retest of FD0530-4
FD0602-2	6/2/97	18	12	22.5	98.8	97.7	101.0	PASS
FD0612-1	6/12/97	20	12	18.1	99.1	121.0	81.9	Recompacted and retested
FD0612-2	6/12/97	20	12	8.6	119.1	121.0	98.4	PASS, retestof FD0612-1
FD0612-3	6/12/97	20	6	13.4	109.3	121.0	90.3	PASS

Table 6: Sandcone Tests for Foundation Compaction

Sand Cone Test No. [1]	Date	Row No.	Col No.	Moisture Content (%)	Dry Density (PCF) [2]	Maximum Dry Density (PCF)	Percent Compaction (%) [3]	Notes
FD0612-4	6/12/97	21	7	18.3	99.4	97.7	102.0	PASS
FD0612-5	6/12/97	21	8	19.5	94.3	97.7	96.5	PASS
FD0613-1	6/13/97	20	8	16.0	92.2	97.7	94.4	PASS
FD0613-2	6/13/97	21	8	18.1	92.7	97.7	94.9	PASS
FD0613-3	6/13/97	20	7	13.3	113.4	121.0	93.7	PASS
FD0613-4	6/13/97	21	8	16.4	96.1	97.7	98.3	PASS
FD0613-5	6/13/97	20	1	15.6	103.9	109.4	95.0	PASS
FD0616-1	6/16/97	21	12	18.8	98.9	97.7	101.0	PASS
FD0617-1	6/17/97	19	11	15.5	116.3	121.0	96.1	PASS
FD0618-1	6/18/97	20	7	15.2	114.0	121.0	94.2	PASS
FD0827-1	8/27/97	22	9	11.2	114.6	120.1	95.4	PASS
FD0827-2	8/27/97	22	10	11.4	120.8	120.1	100.6	PASS
FD0827-3	8/27/97	22	11	13.4	119.4	120.1	99.5	PASS
FD0828-1	8/28/97	22	10	11.5	124.7	120.1	103.8	PASS
FD0829-1	8/29/97	22	12	13.1	121.1	120.1	100.8	PASS
FD0829-2	8/29/97	22	12	11.7	127.1	120.1	105.8	PASS
FD0829-3	8/29/97	22	7	11.0	127.9	120.1	106.5	PASS
FD0829-4	8/29/97	22	7	12.8	119.0	120.1	99.1	PASS
FD0916-1	9/16/97	23	8	6.1	138.4	136.0	101.8	PASS
FD0916-2	9/16/97	23	11	6.3	139.7	136.0	102.8	PASS
FD0917-1	9/17/97	23	10	5.3	130.3	139.7	93.3	PASS
FD0917-2	9/17/97	24	8	11.3	119.4	125.0	95.5	PASS
FD0917-3	9/17/97	23	10	5.9	131.5	139.7	94.1	PASS
FD0918-1	9/18/97	24	12	6.4	131.5	139.7	94.1	PASS
FD0918-2	9/18/97	23	7	6.6	133.2	139.7	95.4	PASS
FD1121-1	11/21/97	25	9	5.0	133.5	136.0	98.2	PASS
TR0225-1	2/25/98	1	7	11.4	122.9	125.0	98.3	PASS
TR0227-1	2/27/98	13	2	15.3	112.5	121.0	93.0	PASS
TR0302-1	3/2/98	11	1	14.6	116.8	121.0	96.5	PASS

NOTES:
1) Sand cone tests were performed in accordance with ASTM D-1556 procedures.
2) pcf = pounds per cubic feet (lb/ft^3)
3) Acceptance criterion for foundation subgrade and fill : 90% of maximum dry density
4) Cohesionless material that could not be tested
5) Recompaction included moisture conditioning and recompaction
6) Tests performed on imported fill placed to meet foundation elevation

Table 7: Summary of Feedstock Pile Testing

Feedstock Pile No.	Proctor Max. Dry Density (pcf)	90% of Proctor Density (pcf)	Estimated Volume (cubic yds[1])	OCS (test date)	OCS pCi/gm [actual] [2]	OCS pCi/gm [calculated][3]
FSP007	123.6	111.2	900.09	08/01/96	25.80	46.56
				08/06/96	22.23	39.99
				08/07/96	22.96	41.34
FSP008	122.9	110.6	879.82	08/07/96	32.68	59.22
				08/08/96	27.73	50.11
				08/08/96	26.48	47.81
FSP009	126.0	113.4	999.56	08/09/96	27.39	49.49
				08/09/96	28.66	51.82
				08/09/96	24.94	44.98
				08/12/96	32.57	59.02
FSP010	125.6	113.0	1703.86	08/10/96	24.50	44.17
				08/12/96	27.44	49.58
				08/12/96	28.41	51.36
				08/13/96	24.56	44.28
FSP011	123.3	111.0	506.23	08/12/96	31.46	56.98
				08/13/96	36.81	66.82
				08/14/96	29.86	54.03
FSP012	128.3	115.5	1020.44	08/13/96	47.80	88.88
				08/14/96	41.14	74.78
				08/16/96	54.31	99.02
				08/16/96	50.43	91.88
				08/16/96	45.31	82.46
				08/17/96	32.84	59.52
				08/17/96	52.57	95.81
FSP013	126.9	114.2	1292.19	08/14/96	48.09	87.57
				08/15/96	66.90	122.18
				08/15/96	49.00	89.25
				08/19/96	48.07	87.53
				08/19/96	54.11	98.65
				08/20/96	45.42	82.66
FSP014	127.5	114.8	1236.84	08/19/96	46.77	85.15
				08/20/96	41.12	74.75
				08/21/96	44.61	81.17
				08/21/96	44.67	81.28
				08/20/96	38.34	69.63
FSP015	126.5	113.9	1269.47	08/20/96	34.62	62.79
				08/21/96	35.13	63.73
				08/22/96	34.06	61.76
				08/22/96	39.87	72.45
				08/22/96	34.38	62.35
FSP016	122.5	110.3	2422.19	08/22/96	34.11	61.85
				08/26/96	58.08	105.95

Table 7: Summary of Feedstock Pile Testing

Feedstock Pile No.	Proctor Max. Dry Density (pcf)	90% of Proctor Density (pcf)	Estimated Volume (cubic yds[1])	OCS (test date)	OCS pCi/gm [actual] [2]	OCS pCi/gm [calculated][3]
FSP016 cont.				08/26/96	16.58	29.59
				08/26/96	48.37	88.09
				08/27/96	46.67	84.96
				08/27/96	57.41	104.70
				08/28/96	45.99	83.71
				08/28/96	40.23	73.11
				09/07/96	37.39	67.89
FSP017	124.5	112.1	1247.54	08/27/96	36.83	66.85
				09/10/96	35.22	63.89
				09/10/96	37.99	68.99
				09/10/96	38.78	70.45
				09/10/96	38.94	70.74
				09/10/96	36.65	66.53
				09/10/96	36.49	66.23
FSP018	124.0	111.6	656.84	09/10/96	38.01	69.03
				09/10/96	38.65	70.21
				09/11/96	32.09	58.13
				09/11/96	32.32	58.55
FSP019	129.0	116.1	629.12	09/11/96	31.70	57.41
				09/11/96	34.89	63.28
				09/12/96	31.05	56.22
				09/12/96	35.55	64.50
				09/13/96	41.19	74.87
FSP020	124.4	112.0	846.75	09/12/96	28.66	51.82
				09/13/96	32.51	58.90
				09/14/96	25.95	46.84
				09/17/96	32.72	59.29
				09/18/96	26.65	48.12
				09/18/96	31.19	56.47
				09/18/96	25.13	45.32
				09/18/96	31.99	57.95
FSP021	122.9	110.6	1834.12	09/14/96	33.01	59.83
				09/18/96	27.99	50.59
				09/19/96	26.32	47.52
				09/19/96	32.15	58.24
				09/19/96	36.31	65.90
				09/19/96	32.77	59.38
				09/20/96	35.84	65.04

Table 7: Summary of Feedstock Pile Testing

Feedstock Pile No.	Proctor Max. Dry Density (pcf)	90% of Proctor Density (pcf)	Estimated Volume (cubic yds[1])	OCS (test date)	OCS pCi/gm [actual] [2]	OCS pCi/gm [calculated][3]
FSP022	123.0	110.7	1206.40	09/20/96	41.53	75.51
				09/21/96	34.64	62.83
				09/21/96	40.19	73.04
				09/21/96	35.08	63.64
				09/21/96	31.42	56.90
				09/21/96	30.67	55.52
				09/21/96	34.70	62.94
				09/23/96	30.64	55.47
				09/23/96	29.85	54.01
				09/23/96	27.09	48.94
				09/23/96	26.47	47.80
				09/24/96	33.57	60.85
				09/24/96	31.93	57.84
				09/24/96	31.97	57.92
FSP023	123.6	111.2	534.21	09/21/96	34.88	63.27
				09/24/96	25.96	46.86
				09/24/96	27.55	49.78
				09/24/96	32.19	58.32
				09/25/96	36.04	65.40
				09/24/96	32.90	59.63
				09/25/96	31.89	57.76
FSP024	123.3	111.0	0.00	09/24/96	34.51	62.59
				09/25/96	45.73	83.23
				09/25/96	38.39	69.73
				09/26/96	37.68	68.42
				09/26/96	36.43	66.12
				09/26/96	45.89	83.52
FSP025	123.8	111.4	622.63	09/26/96	40.64	73.87
				09/27/96	39.77	72.27
				09/27/96	36.89	66.97
				09/27/96	40.39	73.41
				09/27/96	36.49	66.23
				09/27/96	32.53	58.95
				09/28/96	29.66	53.66
				09/28/96	29.40	53.18
FSP026	123.8	111.4	1400.26	09/27/96	39.07	70.98
				09/28/96	43.49	79.12
				09/28/96	47.34	86.20
				09/30/96	39.60	71.95
				09/30/96	46.37	84.41
				09/30/96	37.41	67.92
				09/30/96	35.81	64.98

Table 7: Summary of Feedstock Pile Testing

Feedstock Pile No.	Proctor Max. Dry Density (pcf)	90% of Proctor Density (pcf)	Estimated Volume (cubic yds[1])	OCS (test date)	OCS pCi/gm [actual] [2]	OCS pCi/gm [calculated][3]
FSP026 cont.				09/30/96	15.63	27.58
FSP027	123.1	110.8	**702.89**	09/30/96	33.61	60.93
				09/30/96	42.32	76.96
				10/01/96	42.48	77.25
				10/01/96	34.58	62.72
				10/01/96	34.58	62.72
FSP028	122.6	110.3	**1722.89**	10/01/96	36.80	66.80
				10/01/96	49.31	89.82
				10/01/96	43.69	79.48
				10/02/96	49.53	90.23
				10/02/96	51.61	94.05
				10/02/96	69.80	127.52
				10/02/96	44.13	80.29
				10/02/96	43.75	79.59
				10/02/96	48.24	87.85
				10/02/96	57.37	104.65
				10/02/96	53.84	98.16
				10/03/96	39.11	71.06
				10/03/96	46.32	84.32
FSP029	122.5	110.3	**418.77**	10/02/96	36.66	66.54
				10/02/96	56.86	103.71
				10/03/96	55.60	101.40
				10/03/96	47.42	86.34
				10/03/96	47.02	89.28
				10/03/96	47.86	87.15
				10/03/96	51.65	94.13
FSP030	123.0	110.7	**676.05**	10/05/96	40.79	74.14
				10/07/96	26.34	47.56
				10/07/96	44.97	81.84
				10/07/96	33.01	59.83
				10/08/96	31.04	56.20
				10/08/96	31.88	57.75
				10/08/96	39.27	71.34
FSP031	124.1	111.7	**276.67**	10/08/96	36.34	65.96
FSP032	124.5	112.1	**970.70**	10/09/96	40.17	73.00
				10/09/96	39.10	71.03
				10/09/96	39.78	72.29
				10/09/96	37.05	67.26
				10/10/96	36.35	65.97
				10/09/96	37.31	67.74
				10/10/96	40.73	74.03
				10/09/96	37.06	67.28

Table 7: Summary of Feedstock Pile Testing

Feedstock Pile No.	Proctor Max. Dry Density (pcf)	90% of Proctor Density (pcf)	Estimated Volume (cubic yds[1])	OCS (test date)	OCS pCi/gm [actual] [2]	OCS pCi/gm [calculated][3]
FSP033	124.2	111.8	895.96	10/10/96	35.73	64.83
				10/09/96	28.77	52.94
				10/10/96	28.08	50.76
				10/11/96	36.99	67.15
				10/11/96	38.34	69.64
				10/11/96	36.36	65.99
				10/11/96	37.70	68.46
FSP034	124.8	112.3	1214.30	10/11/96	34.52	62.61
				10/12/96	45.51	82.83
				10/12/96	39.53	71.83
				10/12/96	28.73	51.95
				10/14/96	39.67	72.08
				10/14/96	34.52	62.60
				10/14/96	37.96	68.27
				10/14/96	28.97	52.39
FSP035	126.3	113.7	1010.70	10/15/96	48.60	88.50
				10/15/96	41.31	75.10
				10/15/96	36.35	65.97
				10/15/96	37.33	67.77
				10/15/96	39.84	72.40
				10/16/96	41.62	75.67
				10/16/96	44.66	81.26
FSP036	126.7	114.0	1125.70	10/16/96	36.36	65.99
				10/16/96	39.29	71.38
				10/17/96	39.24	71.29
				10/17/96	37.50	68.09
				10/17/96	41.57	75.57
				10/17/96	29.78	53.88
				10/17/96	34.56	62.68
FSP037	123.6	111.2	1122.19	10/18/96	45.80	83.36
				10/18/96	53.66	97.82
				10/18/96	38.07	69.14
				10/19/96	45.14	82.15
				10/19/96	31.39	56.85
				10/19/96	38.45	69.84
				10/19/96	46.06	83.84

Table 7: Summary of Feedstock Pile Testing

Feedstock Pile No.	Proctor Max. Dry Density (pcf)	90% of Proctor Density (pcf)	Estimated Volume (cubic yds[1])	OCS (test date)	OCS pCi/gm [actual] [2]	OCS pCi/gm [calculated][3]
FSP038	126.0	113.4	1443.33	10/19/96	30.29	54.82
				10/21/96	45.12	82.11
				10/21/96	31.88	57.75
				10/21/96	36.41	66.08
				10/21/96	35.77	64.91
				10/21/96	36.66	66.54
				10/21/96	32.90	59.63
				10/22/96	39.03	70.90
				10/22/96	29.12	52.67
				10/22/96	30.77	55.71
				10/22/96	32.69	59.24
FSP039	124.6	112.1	967.28	10/22/96	34.93	63.36
				10/23/96	29.97	54.23
				10/23/96	40.98	74.49
				10/23/96	33.91	61.48
				10/23/96	32.30	58.52
				10/23/96	29.67	53.68
				10/23/96	19.45	34.88
				10/24/96	41.87	76.13
				10/25/96	36.05	65.42
				10/25/96	28.75	51.99
				10/25/96	37.28	67.69
FSP040	122.5	110.3	1177.28	10/23/96	33.11	60.01
				10/24/96	35.40	64.23
				10/24/96	38.76	70.41
				10/24/96	39.08	71.00
				10/25/96	36.33	65.94
				10/25/96	31.97	57.92
				10/28/96	30.02	54.33
				10/28/96	24.32	43.84
				10/28/96	24.87	44.85
				10/29/96	29.97	54.24
				10/30/96	17.04	30.44
				10/30/96	29.74	53.81
				10/30/96	26.04	47.00
FSP041	125.5	113.0	814.30	10/28/96	30.46	55.14
				10/28/96	30.32	54.88
				10/30/96	37.77	68.59
				10/30/96	32.01	57.99
				10/30/96	31.05	56.22
				10/30/96	36.84	66.88
				10/31/96	38.80	70.48

Table 7: Summary of Feedstock Pile Testing

Feedstock Pile No.	Proctor Max. Dry Density (pcf)	90% of Proctor Density (pcf)	Estimated Volume (cubic yds[1])	OCS (test date)	OCS pCi/gm [actual] [2]	OCS pCi/gm [calculated][3]
FSP041 cont.				11/01/96	38.56	70.04
				11/01/96	38.84	70.56
				11/01/96	35.80	64.96
				11/02/96	33.29	60.34
FSP042	121.5	109.4	**796.05**	10/31/96	30.91	55.96
				11/01/96	23.67	42.64
				11/02/96	27.99	50.59
				11/02/96	29.39	53.17
				11/02/96	29.99	54.27
				11/04/96	26.89	48.57
				11/04/96	30.37	54.97
FSP0-43	125.0	112.5	**781.05**	11/02/96	22.61	40.69
				11/04/96	28.32	51.20
				11/04/96	44.57	81.10
				11/04/96	40.36	73.35
				11/05/96	25.63	46.25
				11/05/96	35.01	63.51
FSP044	123.0	110.7	**662.28**	11/05/96	22.91	41.24
				11/05/96	28.56	51.64
				11/05/96	34.88	63.27
				11/05/96	40.59	73.77
				11/05/96	44.40	80.79
				11/05/96	41.44	75.34
				11/05/96	32.67	59.20
				11/05/96	39.60	71.95
				11/06/96	34.91	63.32
				11/06/96	36.17	65.64
FSP045	123.0	110.7	**959.12**	11/05/96	41.80	76.02
				11/06/96	49.01	89.27
				11/06/96	52.17	95.08
				11/06/96	43.28	78.73
				11/06/96	48.96	89.18
				11/07/96	44.84	81.60
				11/07/96	50.10	92.37
				11/08/96	35.59	64.57
				11/08/96	33.82	61.31
				11/09/96	31.33	56.74
				11/09/96	37.09	67.33
				11/09/96	31.73	57.47

Table 7: Summary of Feedstock Pile Testing

Feedstock Pile No.	Proctor Max. Dry Density (pcf)	90% of Proctor Density (pcf)	Estimated Volume (cubic yds[1])	OCS (test date)	OCS pCi/gm [actual] [2]	OCS pCi/gm [calculated][3]
FSP046	123.5	111.2	**1559.74**	11/07/96	39.05	70.94
				11/09/96	37.28	67.68
				11/09/96	34.97	63.43
				11/11/96	33.96	61.57
				11/11/96	31.72	57.46
				11/11/96	34.48	62.53
				11/11/96	38.60	70.11
				11/12/96	30.02	54.33
				11/12/96	27.21	49.16
				11/12/96	20.23	36.31
FSP047	124.5	112.1	**403.77**	11/11/96	34.13	61.89
				11/12/96	18.15	32.49
				11/12/96	28.34	51.23
				11/13/96	27.37	49.45
				11/13/96	31.08	56.28
				11/14/96	23.53	42.39
				11/14/96	28.21	50.99
FSP048	123.5	111.2	**659.21**	11/13/96	25.81	46.58
				11/19/96	32.58	59.03
				11/21/96	37.20	67.53
				11/22/96	34.89	63.29
				11/22/96	19.85	35.61
				11/22/96	28.51	51.55
				11/22/96	24.31	43.82
FSP049	122.7	110.4	**637.02**	11/20/96	37.29	67.70
				11/21/96	30.77	55.70
				11/21/96	34.28	62.16
				11/21/96	40.14	72.95
				11/21/96	42.50	77.29
FSP050	124.3	111.9	**823.33**	11/23/96	27.95	50.52
				11/25/96	33.27	60.31
				11/25/96	28.50	51.53
				11/25/96	32.36	58.63
				11/25/96	29.86	54.03
FSP051	124.5	112.1	**1347.89**	11/25/96	31.59	57.22
				11/26/96	25.41	51.36
				11/26/96	40.04	72.76
				11/26/96	30.06	54.40
				11/26/96	28.51	51.54
				12/02/96	35.37	64.17
				12/03/96	39.67	72.08
				12/03/96	31.62	57.27

Table 7: Summary of Feedstock Pile Testing

Feedstock Pile No.	Proctor Max. Dry Density (pcf)	90% of Proctor Density (pcf)	Estimated Volume (cubic yds[1])	OCS (test date)	OCS pCi/gm [actual] [2]	OCS pCi/gm [calculated][3]
FSP051 cont.				12/03/96	42.98	78.17
				12/03/96	35.23	63.91
				12/03/96	25.99	46.91
FSP052	119.3	107.4	**867.98**	11/27/96	34.99	63.47
				12/03/96	30.90	55.96
				12/04/96	23.74	42.77
				12/05/96	50.58	92.15
				12/05/96	28.50	51.53
				12/05/96	54.50	99.37
				12/05/96	34.50	62.57
				12/05/96	34.48	62.53
				12/06/96	32.74	59.33
FSP053	123.5	111.2	**1921.58**	12/03/96	20.10	36.81
				12/05/96	34.50	62.57
				12/06/96	23.74	42.77
				12/06/96	21.55	38.74
				12/06/96	24.47	44.12
				12/06/96	19.62	35.19
				12/06/96	23.20	41.78
				12/07/96	22.06	39.68
				12/07/96	32.35	58.61
				12/07/96	30.08	54.44
				12/07/96	30.41	55.04
				12/07/96	19.81	35.54
				12/09/96	28.35	51.25
				12/09/96	30.39	55.00
				12/09/96	34.56	62.68
				12/09/96	36.30	65.88
FSP054	123.3	111.0	**740.26**	12/07/96	16.76	29.93
				12/10/96	39.05	70.94
				12/10/96	29.90	54.11
				12/10/96	28.17	50.92
				12/10/96	55.47	60.68
				12/10/96	24.97	45.03
FSP055	127.0	114.3	**1749.65**	12/10/96	26.91	48.60
				12/11/96	17.90	32.02
				12/11/96	39.88	72.46
				12/12/96	20.33	36.49
				12/12/96	18.18	32.54
				12/12/96	26.87	48.53
				12/12/96	27.61	49.89
				12/12/96	25.21	45.47

Table 7: Summary of Feedstock Pile Testing

Feedstock Pile No.	Proctor Max. Dry Density (pcf)	90% of Proctor Density (pcf)	Estimated Volume (cubic yds[1])	OCS (test date)	OCS pCi/gm [actual] [2]	OCS pCi/gm [calculated][3]
FSP055 cont				12/13/96	28.36	51.27
				12/13/96	23.96	43.18
FSP056	122.7	110.4	**651.14**	12/12/96	35.23	63.91
				12/13/96	34.74	63.01
				12/13/96	32.15	58.25
				12/13/96	26.36	47.59
				12/14/96	26.25	47.39
				12/14/96	24.52	44.21
FSP057	123.5	111.2	**168.33**	12/13/96	21.50	38.65
				12/14/96	21.31	38.30
				12/16/96	18.97	33.99
				12/16/96	23.46	42.26
				12/16/96	23.59	42.44
FSP058	122.9	110.6	**802.02**	01/18/97	17.40	31.11
FSP059[4]	122.5	110.3	**888.33**	01/22/97	35.60	64.60
				01/22/97	37.60	68.30
				01/22/97	94.00	172.05
				01/22/97	87.50	160.10
				01/22/97	39.00	70.80
				01/23/97	24.67	44.48
				01/24/97	27.26	49.25
FSP060	122.5			01/22/97	67.50	123.40
				01/22/97	42.20	76.70
				01/23/97	39.78	72.29
				01/24/97	39.23	71.27
FSP061	122.0			01/24/97	24.42	44.08
FSP060	122.4	110.2	**572.95**	5/7/97	32.80	59.44
				5/19/97	38.15	69.29
				5/21/97	29.10	52.63
FSP061	124.1	111.7	**445.90**	5/8/97	32.19	58.32
				5/15/97	21.35	38.37
				5/19/97	25.85	46.65
				5/19/97	22.17	39.88
FSP062	124.0	111.6	**1526.23**	5/12/97	44.26	80.53
				5/23/97	24.60	44.35
				5/28/97	23.42	42.18
FSP063	121.8	109.6	**1986.90**	5/19/97	25.72	46.41
				5/28/98	28.48	51.49
				6/2/97	27.91	50.44
				6/4/97	35.57	64.54
FSP064	122.5	110.3	**952.46**	6/4/97	45.83	83.42

Table 7: Summary of Feedstock Pile Testing

Feedstock Pile No.	Proctor Max. Dry Density (pcf)	90% of Proctor Density (pcf)	Estimated Volume (cubic yds[1])	OCS (test date)	OCS pCi/gm [actual] [2]	OCS pCi/gm [calculated][3]
FSP065	122.6	110.3	386.07	6/10/97	42.62	77.51
FSP066	121.4	109.3	891.80	6/19/97	49.30	89.80
				6/19/97	46.04	83.80
FSP067	120.6	108.5	929.51	6/19/97	43.47	79.07
				6/20/97	37.95	68.92
FSP068	122.3	110.1	450.82	6/25/97	33.51	60.75
FSP069	123.4	111.1	1333.60	6/25/97	38.35	69.65
FSP070	122.2	110.0	1590.99	7/1/97	22.74	40.93
				7/1/97	40.82	74.20
FSP071	122.2	110.0	866.39	7/9/97	35.01	63.51
				7/9/97	36.06	65.44
FSP072	121.1	109.0	575.41	7/9/97	28.67	51.84
FSP073	125.5	113.0	558.20	7/9/97	29.20	52.82
FSP074	122.2	110.0	915.58	7/9/97	28.19	50.96
				7/15/97	39.30	71.40
FSP075	120.5	108.5	645.09	7/15/97	35.76	64.89
				7/15/97	45.71	83.20
				7/15/97	32.83	59.50
FSP076	121.6	109.4	1552.46	7/15/97	33.00	59.81
				7/30/97	43.10	78.39
FSP077	122.5	110.3	1158.19	7/30/97	46.84	85.28
FSP078	121.9	109.7	1088.52	8/7/97	31.81	57.62
FSP079	122.0	109.8	1818.84	8/15/97	41.86	76.11
				8/15/97	31.90	57.79
FSP080	121.0	108.9	1454.10	8/21/97	41.21	74.92
FSP081	122.3	110.1	1677.05	8/27/97	5.27	8.79
FSP082	122.4	110.2	1793.45	8/29/97	43.85	79.77
FSP083	122.7	110.4	698.36	9/4/97	46.67	84.96
FSP084	121.2	109.1	1313.12	9/4/97	34.04	61.72
FSP085	123.3	111.0	2369.67	9/18/97	32.81	59.46
FSP086	120.4	108.4	1840.98	9/23/97	19.48	34.93
FSP087	120.2	108.2	3290.98	10/12/97	24.49	44.15
FSP088	122.0	109.8	1309.84	10/22/97	18.54	33.20

Notes:

[1]Feedstock pile volumes based on wet unit weight of 84.4 pcf (1.14 tons/cy) for FSP 1-59 and 90 pcf (1.22 tons/cy) for FSP 60-88.

[2]Actual = measured concentration

[3]Calculated = imperical correction factor for both moisture and radium-radon disequilibrium

Calculated = (1.84*Actual)-0.91, Chapter 4 of Field Assessment Procedures Manual

[4]The third and fourth samples from FSP-059 had elevated radiation readings due to direct feed to crusher hopper, then to feedstock pile area.

Table 7: Summary of Feedstock Pile Testing

Feedstock Pile No.	Proctor Max. Dry Density (pcf)	90% of Proctor Density (pcf)	Estimated Volume (cubic yds[1])	OCS (test date)	OCS pCi/gm [actual] [2]	OCS pCi/gm [calculated][3]
FSP001	124.0	111.6	1586.75	06/29/96	25.81	46.58
				07/10/96	27.11	48.97
				07/11/96	26.20	47.30
				07/11/96	27.78	50.21
				07/11/96	24.23	43.67
				07/11/96	25.69	46.36
FSP002	127.8	115.0	1609.30	06/29/96	6.33	10.74
				07/10/96	17.40	31.06
				07/24/96	23.61	42.53
				07/25/96	22.78	41.01
				07/25/96	25.46	45.94
				07/26/96	6.78	11.56
				07/26/96	6.83	11.66
				07/27/96	23.06	41.52
FSP003	131.0	117.9	1509.56	06/29/96	8.54	14.80
				07/10/96	37.28	67.68
				07/10/96	38.61	66.45
				07/12/96	41.32	75.12
				07/16/96	40.88	74.31
				07/17/96	38.92	70.70
				07/17/96	38.38	69.71
				07/22/96	36.25	65.79
				07/23/96	33.05	60.73
				07/23/96	38.45	69.84
				07/24/96	32.63	59.12
FSP004	133.9	120.5	887.63	07/15/96	38.25	69.47
	131.5	118.4		07/17/96	39.12	71.07
				07/18/96	35.29	64.02
				07/19/96	34.31	62.22
				07/22/96	36.03	65.38
				07/22/96	35.22	63.89
FSP005	124.8	112.3	862.98	07/26/96	39.88	72.47
				07/27/96	30.11	54.49
				07/27/96	23.62	42.50
				07/30/96	28.01	50.63
FSP006	121.6	109.4	2388.95	07/26/96	27.50	49.69
				08/01/96	19.42	34.82
				08/02/96	23.38	42.11
				08/02/96	27.68	50.02
				08/05/96	23.05	41.50
				08/05/96	19.51	34.98
				08/06/96	17.00	30.37

Table 8: Daily Pugmill Production Report

Date	Feed Stockpile No.	Soil/Cement/Flyash Ratio	Soil (tons)	Cement (tons)	Flyash (tons)	Water (tons)	Reject (tons)	Total (tons)	Production Rate (tons/hr)
1-Jul-96	1	65.7/22.0/12.2	387.1	115.4	64.2	82.4	60	589.1	69.3
9-Jul-96	1	67.1/23.2/9.7	243.2	75.1	31.3	21.4	0	371	43.6
10-Jul-96	1	69.6/22.2/8.3	545.6	153.8	57.3	50.7	0	807.4	89.7
11-Jul-96	1	67.7/22.8/9.5	633	189.3	79.2	60.7	0	962.2	101.3
17-Jul-96	3/4	69.0/21.0/10.0	342.8	97.9	46.1	28.8	0	515.6	79.3
18-Jul-96	4	66.0/24.0/9.0	381.7	127.9	49.6	22.7	0	581.9	72.7
19-Jul-96	4	71.0/18.8/9.9	116.1	27.7	13.9	9.8	0	167.5	83.8
22-Jul-96	3/4	72.0/17.0/11.0	467.9	97.4	63.6	29.1	0	658	84.9
23-Jul-96	3	69.7/20.0/10.3	823.9	215.6	111.4	59.1	0	1210	127.4
24-Jul-96	2/3	69.2/20.2/10.8	1028.7	270.8	141.8	75.5	10	1506.8	162.9
25-Jul-96	2	69.1/20.1/10.8	970.1	246	132.3	51.2	0	1399.6	151.3
26-Jul-96	2	70.9/19.0/10.1	436.2	102.7	54.8	22.9	0	616.6	123.3
27-Jul-96	5	70.0/20.0/10.0	763.9	190.6	95	40.6	0	1090.1	167.7
30-Jul-96	5	67.0/19.5/12.8	219.9	56.1	36.7	17.1	23	306.8	204.5
1-Aug-96	6	70.1/19.9/10.0	239.7	60.7	30.5	15.1	0	346	153.8
2-Aug-96	6	69.0/19.9/11.1	1056.3	268.3	147.9	58.8	0	1533.3	161.4
5-Aug-96	6	69.7/20.0/10.3	1015.3	255.3	132.3	55.3	57.5	1400.7	164.8
6-Aug-96	6/7	69.7/20.0/10.3	837.2	212.6	109.8	49.1	11.5	1197.2	129.4
7-Aug-96	7	69.8/20.4/9.8	601	158.3	76.5	46.1	0	881.9	113.8
8-Aug-96	8	69.0/20.6/10.4	1003	261.8	132.8	73.8	0	1471.4	163.5
9-Aug-96	9	69.3/19.7/11.0	601.2	151	84.7	84.5	17.3	904.1	212.7
10-Aug-96	9/10	69.9/20.2/9.9	981.5	252.5	123.3	71.9	13	1416.2	157.4
12-Aug-96	10	69.3/20.2/10.5	523.5	134.6	70.4	34.8	0	763.3	169.6
13-Aug-96	10	69.9/20.2/9.9	975.7	250.8	123.5	64.6	0	1414.6	152.9
14-Aug-96	11	67.9/19.9/12.2	577.1	150.7	92.3	40	23	837.1	139.5
16-Aug-96	12	70.1/19.1/10.8	663.7	167.5	93.9	50.8	0	975.9	130.1
17-Aug-96	12/13	69.0/20.2/10.8	1049.2	277.6	147.7	79.2	0	1553.7	168
19-Aug-96	13	69.5/20.4/10.1	923.5	242.8	119.6	68.4	23	1331.3	156.6
20-Aug-96	14	69.3/20.3/10.4	917.2	241.8	124.1	66.1	23	1326.2	139.6
21-Aug-96	14/15	69.4/20.6/10.0	645.7	172.3	82.6	43.4	23	921	115.1
22-Aug-96	15	68.6/20.2/11.2	886.6	231.5	128.2	55.6	72.6	1229.3	144.6
23-Aug-96	15	69.1/20.1/10.8	407.7	105.7	56.9	27	0	597.3	89.1
26-Aug-96	16	68.2/19.6/12.1	522.5	131.9	81.6	45	23	758	151.6
27-Aug-96	16	69.4/20.2/10.4	1087	277.5	143.5	99.6	0	1607.6	164.9
28-Aug-96	16	69.0/20.1/10.9	817.2	208.3	113.2	71.8	0	1210.5	151.3

Table 8: Daily Pugmill Production Report

Date	Feed Stockpile No.	Soil/Cement/Flyash Ratio	Soil (tons)	Cement (tons)	Flyash (tons)	Water (tons)	Reject (tons)	Total (tons)	Production Rate (tons/hr)
7-Sep-96	16	67.5/19.6/12.9	334.6	84.8	55.7	29.7	23	481.8	160.6
9-Sep-96	17	68.8/19.4/11.8	471.1	118	71.7	44.3	27	678.1	84.8
10-Sep-96	17	69.8/20.1/10.1	951.1	246.4	123.2	81	0	1401.7	150.2
11-Sep-96	18	69.4/19.9/10.7	748.8	191.8	103.4	58.8	15	1087.8	130.6
13-Sep-96	19	70.8/19.6/9.6	717.2	173.9	84.4	57	120	912.5	110.6
18-Sep-96	20	69.9/20.2/9.9	965.3	238.9	116.7	88	0	1408.9	134.2
19-Sep-96	21	69.3/19.9/10.8	875.9	215.1	117.5	52.9	24	1237.4	153.1
21-Sep-96	21	68.4/20.2/11.4	700.9	181.5	102.7	51.9	7	1030	124.8
23-Sep-96	21	69.0/20.1/10.9	514.1	128.2	69.6	17.6	12.5	717	89.6
24-Sep-96	22	70.4/19.9/9.7	876	215	105.3	55.8	12.5	1239.6	116.3
25-Sep-96	22	70.2/20.1/9.7	499.3	121.6	58.8	43.2	37.5	685.4	137.1
26-Sep-96	23	70.1/20.6/9.3	609	156.4	70.6	42.5	0	878.5	146.4
27-Sep-96	25	70.0/19.9/10.1	709.8	174.8	88.2	40.1	0	1012.9	135.1
28-Sep-96	26	70.2/19.9/9.9	939.3	232.2	114.3	54.3	0	1340.1	163.4
30-Sep-96	26/27	69.9/20.1/10.0	1192.8	299	147.7	64.4	0	1703.9	167.7
1-Oct-96	27/28	71.0/20.2/8.8	719.7	178.2	79.1	46.7	0	1023.7	104.1
2-Oct-96	28	69.7/20.1/10.3	1032.5	262.9	134.7	72.5	0	1502.6	158.2
3-Oct-96	28/29	69.7/19.8/10.5	716.9	177.8	94.1	59.5	38.3	1010	113.2
7-Oct-96	30	69.5/20.0/10.5	356.3	88.6	46.4	21.4	0	512.7	140.1
8-Oct-96	30/31	69.9/19.8/10.3	729.8	182.3	94.9	46.7	0	1053.7	131.7
9-Oct-96	32	71.9/20.1/8	593.3	146.5	58.3	40.8	0	838.9	130.7
10-Oct-96	32/33	70.8/19.7/9.5	856.8	212	101.1	61.8	0	1231.7	154
11-Oct-96	33	70.8/19.7/9.5	677.9	167	79.9	50	0	974.8	131.2
12-Oct-96	34	70.9/20.1/9.0	513.1	129.4	57.8	39.2	0	739.5	177.3
14-Oct-96	34	71.2/20.0/8.8	871.2	217.7	95	65.8	20	1229.7	149.1
15-Oct-96	35	71.4/19.8/8.8	983.3	243.5	108.6	60.3	0	1395.7	153.7
16-Oct-96	35	71.2/19.7/9.1	448	108.2	49.7	25.2	0	631.1	66.4
17-Oct-96	36	70.1/19.6/10.3	1004.2	251.3	131.4	72.5	0	1459.4	152.3
18-Oct-96	37	69.8/19.6/10.6	614.4	154	83.1	39.4	0	890.9	110.3
19-Oct-96	37/38	70.3/19.5/10.2	985.9	241.7	126.1	67.9	104	1317.6	141.2
21-Oct-96	38	70.3/20.0/9.7	782.5	194.9	95.1	53.7	0	1126.2	177.9
22-Oct-96	38	68.7/19.7/11.6	541.9	136.9	80.8	38.2	100	697.8	114.8
23-Oct-96	39	69.2/19.8/11.0	881.7	223.4	126.7	67.5	67.5	1231.8	137.9
25-Oct-96	39/40	70.3/19.6/10.1	489.7	121.2	61.8	35.3	27	681	75.9
28-Oct-96	40	69.0/19.6/11.4	725.6	183	106.3	55.1	54	1016	129.1

Table 8: Daily Pugmill Production Report

Date	Feed Stockpile No.	Soil/Cement/Flyash Ratio	Soil (tons)	Cement (tons)	Flyash (tons)	Water (tons)	Reject (tons)	Total (tons)	Production Rate (tons/hr)
30-Oct-96	40	70.4/19.6/10.0	986.4	246.5	125.2	75.9	4	1430	135.8
1-Nov-96	41	70.7/19.4/9.9	558.4	135.1	68.7	42.5	0	804.7	169.4
2-Nov-96	42	69.9/20.1/10.7	670	173	92.2	53.9	0	989.1	159.5
4-Nov-96	42/43	70.6/19.7/9.7	913.1	224.2	109.5	65	0	1311.8	141.8
5-Nov-96	44	70.6/20.0/9.4	671.6	168.2	79.5	48.2	2	965.5	107.3
6-Nov-96	44	69.0/20.1/10.9	306.7	79.1	42.9	23.3	12	440	176
7-Nov-96	45	71.1/19.7/9.2	468.5	113.8	52.9	29.2	0	664.4	139.9
8-Nov-96	45	71.1/20.2/8.7	225.6	56.4	24.4	14.8	1.2	320	129.6
9-Nov-96	45/46	69.6/19.7/10.7	813	201.1	108.7	50.1	0	1172.9	128.6
11-Nov-96	46	69.5/19.6/10.9	833.7	206.4	114.5	57.3	0	1211.9	135.9
12-Nov-96	46/47	69.3/20.0/10.7	862.8	220.5	119.2	63.9	0	1266.4	128.8
13-Nov-96	47	71.2/20.1/8.7	46.4	11.6	5	3.6	0	66.6	88.8
14-Nov-96	47	71.3/19.6/9.1	73.3	17.9	8.2	5.8	0	105.2	60.8
21-Nov-96	49	70.2/19.4/10.4	726.2	176.2	94.4	56.5	0	1053.3	154.2
22-Nov-96	48	69.2/19.4/11.4	751.5	184	108.7	58.1	0	1102.3	120.3
25-Nov-96	50	70.2/19.5/10.3	938.6	228.9	121.6	76.6	0	1365.7	136.6
26-Nov-96	51	70.4/20.2/9.4	533.4	134.4	62.5	44.6	0	774.9	119.2
2-Dec-96	51	69.2/19.7/11.1	195.2	48	27	12.8	0	283	94.3
3-Dec-96	51	70.3/19.5/10.2	808	197.5	102.8	61.8	0	1170.1	135
5-Dec-96	52	70.6/19.9/9.5	989.5	237.4	113.2	67.1	0	1407.2	141.9
6-Dec-96	53	71.0/19.8/9.2	770.9	183.6	85.3	52.2	0	1092	120.2
7-Dec-96	53	69.9/19.8/10.3	734.2	182.3	95.1	49.7	0	1061.3	132.7
9-Dec-96	53	70.9/20.0/9.1	685.5	168.3	77.2	52.3	0	983.3	108.7
10-Dec-96	54	71.1/19.8/9.1	843.9	204.3	93.5	63.6	0	1205.3	129.6
11-Dec-96	55	70.4/19.9/9.7	889	222.6	108.2	57.6	0	1277.4	150.8
12-Dec-96	55	70.1/19.5/10.4	825.2	202.3	108.6	55.8	0	1191.9	130.3
13-Dec-96	55/56	70.9/19.7/9.4	783.8	190.8	91.5	56.4	0	1122.5	134.4
14-Dec-96	56	70.0/20.0/10.0	238.9	58.4	29.1	16.7	0	343.1	114.4
16-Dec-96	57	70.5/20.0/9.5	191.9	48.3	22.8	15	0	278	101.1
20-Jan-97	58	68.9/20.0/11.1	914.3	229.8	127.3	70.4	0	1341.8	143.5
21-Jan-97	59	69.3/20.0/10.0	1012.7	253.6	133.6	73.2	0	1473	145.1
15-May-97	61	70.0/20.0/10.0	60	15	7.5	7.25	89.75	0	0
16-May-97	61	70.3/19.7/10.0	315	77.5	39.5	25.5	0	457.5	81.99
19-May-97	61/60	70.3/19.6/10.1	317	75.75	39	26.75	0	458.5	152.83
20-May-97	60	69.7/20.0/10.2	394	99.6	51	39.4	0	584	125.05

Table 8: Daily Pugmill Production Report

Date	Feed Stockpile No.	Soil/Cement/Flyash Ratio	Soil (tons)	Cement (tons)	Flyash (tons)	Water (tons)	Reject (tons)	Total (tons)	Production Rate (tons/hr)
21-May-97	60/62	69.8/20.1/10.1	492	125	63	49.2	0	729.2	105.38
23-May-97	62	69.8/20.1/10.1	550	140	70.5	59.8	0	820.3	144.67
27-May-97	62	69.8/20.0/10.2	570	144.5	73.5	66.3	0	854.3	131.43
28-May-97	62/63	69.9/20.0/10.1	786	199	101	87.5	0	1173.5	146.69
3-Jun-97	63	69.9/20.0/10.1	803	203	102	84.5	0	1192.5	170.36
4-Jun-97	63	69.9/20.0/10.1	716	180	91	80.9	0	1067.9	128.20
5-Jun-97	63/64	69.9/20.0/10.1	1033	260	131	114	0	1538.0	157.74
6-Jun-97	64	69.9/20.1/10.0	407	103	51.5	45.6	0	607.1	158.51
17-Jun-97	64/65	69.7/20.1/10.2	616	152	77	69	0	914.0	203.11
18-Jun-97	65/66	70.0/20.0/9.9	663	162	80.5	65.2	0	970.65	121.33
19-Jun-97	66	69.8/20.1/10.1	416	104	52.5	37.4	0	609.9	217.82
20-Jun-97	66/67	69.8/20.1/10.2	1246	310	157	127	0	1840.0	187.76
24-Jun-97	68/69	69.9/20.0/10.1	850	214	108	82.2	0	1254.2	177.15
30-Jun-97	69B	70.0/20.0/10.0	1085	269	135	110	0	1599.0	184.43
1-Jul-97	69/70	69.9/20.0/10.1	1036	260	130.5	107	0	1533.5	180.41
2-Jul-97	70	69.9/20.1/10.1	1017	253	127	106.5	0	1503.5	171.44
3-Jul-97	70/71	69.9/20.1/10.0	910	230	115	96.5	0	1351.5	167.26
7-Jul-97	71/72	69.9/20.1/10.0	758	192	96	79.3	0	1125.25	166.70
8-Jul-97	72/73	70.0/20.0/10.0	902	226	113	95.5	0	1336.5	186.92
10-Jul-97	74	69.9/20.0/10.0	928	234	117	98	0	1377.0	170.42
11-Jul-97	74/75	70.1/19.9/10.0	810	201	100.5	85	0	1196.5	149.56
14-Jul-97	75	69.8/20.1/10.1	166	42	21	17.5	0	246.5	185.34
24-Jul-97	76	69.9/20.0/10.0	1180	302	151.5	125.1	0	1758.6	188.49
25-Jul-97	76	69.9/20.0/10.0	644	164.5	82.5	66.5	0	957.5	178.31
31-Jul-97	76/77	69.8/20.1/10.1	726	184.5	92.5	67.2	0	1070.2	180.78
8-Aug-97	77	70.0/20.0/10.0	757	183	91.5	54	0	1085.5	164.97
11-Aug-97	78	70.0/20.0/10.0	790	192	96	65	0	1143.0	163.29
13-Aug-97	78/79	69.9/20.0/10.1	1076	265	133	87	0	1561.0	173.44
15-Aug-97	79	69.9/20.0/10.0	815	201	100.5	64.5	54.00	1127.0	166.96
18-Aug-97	79	69.9/20.0/10.0	541.4	134	67	50	0	792.4	169.68
21-Aug-97	79/80	70.0/20.0/10.0	1085	270	135	109.5	0	1599.5	172.92
22-Aug-97	80	70.0/20.0/10.0	850	211	105.5	93	0	1259.5	164.21
25-Aug-97	80/81	70.0/20.0/10.0	1270	315.5	158	146.5	18.00	1872.0	182.63
26-Aug-97	81	70.0/20.0/10.0	940	239	119.5	102	0	1400.5	161.53
28-Aug-97	82	69.9/20.0/10.0	743	185.5	93	78.9	0	1100.4	178.35

Table 8: Daily Pugmill Production Report

Date	Feed Stockpile No.	Soil/Cement/Flyash Ratio	Soil (tons)	Cement (tons)	Flyash (tons)	Water (tons)	Reject (tons)	Total (tons)	Production Rate (tons/hr)
29-Aug-97	82	69.9/20.0/10.1	350	88.5	44.5	37.1	0	520.1	63.66
2-Sep-97	82	70.0/20.0/10.0	927	231	115.5	92	0	1365.5	188.34
3-Sep-97	82/83	70.0/20.0/10.0	765	190	95	71.8	0	1121.8	168.19
4-Sep-97	83/84	69.9/20.0/10.1	1051	264.5	133	104.6	0	1553.1	179.97
5-Sep-97	84	70.0/20.0/10.0	806	194	97	70.5	0	1167.5	166.79
19-Sep-97	85	70.0/20.0/10.0	461	114.5	57.5	47	0	680.0	148.47
22-Sep-97	85	69.9/20.0/10.0	643	160	80	65	0	948.0	189.60
24-Sep-97	86	70.0/20.0/10.0	663	162.5	81.5	61	0	968.0	154.39
25-Sep-97	86	70.0/20.0/10.0	997	243.5	122	86.5	0	1449.0	182.95
29-Sep-97	86	69.9/20.0/10.1	586	149	75.5	54	0	864.5	167.21
30-Sep-97	87	69.9/20.0/10.0	662	163.5	82	62	0	969.5	147.34
1-Oct-97	85	70.0/20.0/10.0	749	186.5	93.5	71.50	0	1100.5	191.39
14-Oct-97	85	70.0/20.0/10.0	501	126	63	51.50	0	741.5	207.12
16-Oct-97	85/87	70.0/20.0/10.0	745	188.5	94.5	76	0	1104.0	270.59
17-Oct-97	87	70.0/20.0/10.0	1117	284.5	142.5	114	0	1658.0	176.01
22-Oct-97	87	69.9/20.0/10.0	713	182	91	72.50	0	1058.5	181.56
24-Oct-97	87	69.9/20.0/10.1	304	77.5	39	27	0	447.5	158.13
29-Oct-97	87	70.0/20.0/10.0	707	172.5	86.5	58	0	1024.0	157.54
30-Oct-97	87/88	69.9/20.0/10.1	605	146.5	73.5	49	0	874.0	166.48
31-Oct-97	88	69.9/20.1/10.0	240	60	30	17	0	347.0	192.78
5-Nov-97	88	70.0/20.0/10.0	221	56	28	18	0	323.0	120.97
6-Nov-97	88	70.0/20.0/10.0	521	131	65.5	39	0	756.5	110.76
13-Nov-97	88	69.9/20.0/10.1	315	78.5	39.5	22	0	455.0	82.73
TOTALS			113,681.6	28,585.6	14,508.7	9,400.8	1,500.0	164,678.6	

Table 9: Unconfined Compressive Strength (UCS) Test Results

Collection Date	Feedstock Pile Number	Age of Soil-Cement Test Cylinder		
		3-day UCS (psi)	7-day UCS (psi)	28-day UCS (psi)
7/1/96	FSP001	923		
7/1/96	FSP001	2348		
7/1/96	FSP001	992*		
7/1/96	FSP001	1115*		
7/1/96	FSP001	902		
7/1/96	FSP001	670		
7/1/96	FSP001	836*		
7/1/96	FSP001	925*		
7/1/96	FSP001	756		
7/1/96	FSP001	913		
7/1/96	FSP001	751*		
7/1/96	FSP001	680*		
7/9/96	FSP001	802		
7/9/96	FSP001	702		
7/9/96	FSP001	869*		
7/9/96	FSP001	775*		
7/9/96	FSP001	1041		
7/9/96	FSP001	1179		
7/9/96	FSP001	1003*		
7/9/96	FSP001	886*		
7/10/96	FSP001	666		
7/10/96	FSP001	597		
7/10/96	FSP001	702*		
7/10/96	FSP001	842*		
7/10/96	FSP001	1032		
7/10/96	FSP001	1182		
7/10/96	FSP001	1541*		
7/10/96	FSP001	1258*		
7/10/96	FSP001	721		
7/10/96	FSP001	666		
7/10/96	FSP001	895*		
7/10/96	FSP001	826*		
7/10/96	FSP001	1676		
7/10/96	FSP001	1583		
7/10/96	FSP001	1582*		
7/10/96	FSP001	1998*		
7/11/96	FSP001	784		
7/11/96	FSP001	631		
7/11/96	FSP001		1063	
7/11/96	FSP001		770	
7/11/96	FSP001	855		
7/11/96	FSP001	719		
7/11/96	FSP001		992	
7/11/96	FSP001		981	
7/11/96	FSP001	937		
7/11/96	FSP001	1026		
7/11/96	FSP001		1127	
7/11/96	FSP001		894	
7/11/96	FSP001	770		
7/11/96	FSP001	808		
7/11/96	FSP001		897	

Table 9: Unconfined Compressive Strength (UCS) Test Results

Collection Date	Feedstock Pile Number	Age of Soil-Cement Test Cylinder		
		3-day UCS (psi)	7-day UCS (psi)	28-day UCS (psi)
7/11/96	FSP001		973	
7/23/96	FSP003	1070		
7/23/96	FSP003	816		
7/23/96	FSP003		1115	
7/23/96	FSP003		1218	
7/24/96	FSP002	887		
7/24/96	FSP002	919		
7/24/96	FSP002		980	
7/24/96	FSP002		746	
7/24/96	FSP002	948		
7/24/96	FSP002	877		
7/24/96	FSP002		1958	
7/24/96	FSP002		1268	
7/25/96	FSP002	1742		
7/25/96	FSP002	1878		
7/25/96	FSP002		2036	
7/25/96	FSP002		1590	
7/25/96	FSP002	1569		
7/25/96	FSP002	1224		
7/25/96	FSP002		1371	
7/25/96	FSP002		1567	
7/26/96	FSP002	981		
7/26/96	FSP002	1083		
7/26/96	FSP002		993	
7/26/96	FSP002		1178	
7/26/96	FSP002	893		
7/26/96	FSP002	1074		
7/26/96	FSP002		1171	
7/26/96	FSP002		1277	
7/27/96	FSP002	796		
7/27/96	FSP002	928		
7/27/96	FSP002		1395	
7/27/96	FSP002		1173	
7/12/96	FSP003	1968		
7/12/96	FSP003	1152		
7/12/96	FSP003		1993	
7/12/96	FSP003		2045	
7/15/96	FSP003	905		
7/15/96	FSP003	842		
7/15/96	FSP003		1108	
7/15/96	FSP003		1113	
7/17/96	FSP003	786		
7/17/96	FSP003	1123		
7/17/96	FSP003		1171	
7/17/96	FSP003		1042	
7/17/96	FSP003	705		
7/17/96	FSP003	887		
7/17/96	FSP003		843	
7/17/96	FSP003		1000	
7/17/96	FSP003	914		

Table 9: Unconfined Compressive Strength (UCS) Test Results

Collection Date	Feedstock Pile Number	Age of Soil-Cement Test Cylinder		
		3-day UCS (psi)	7-day UCS (psi)	28-day UCS (psi)
7/17/96	FSP003	766		
7/17/96	FSP003		939	
7/17/96	FSP003		881	
7/22/96	FSP003	1042		
7/22/96	FSP003	1681		
7/22/96	FSP003		2787	
7/22/96	FSP003		1377	
7/23/96	FSP003	1460		
7/23/96	FSP003	1448		
7/23/96	FSP003		1458	
7/23/96	FSP003		1361	
7/23/96	FSP003	847		
7/23/96	FSP003	674		
7/23/96	FSP003		791	
7/23/96	FSP003		853	
7/23/96	FSP003	1319		
7/23/96	FSP003	1174		
7/23/96	FSP003		1445	
7/23/96	FSP003		1288	
7/24/96	FSP003	1529		
7/24/96	FSP003	1398		
7/24/96	FSP003		2053	
7/24/96	FSP003		1197	
7/24/96	FSP003	1320		
7/24/96	FSP003	1153		
7/24/96	FSP003		1323	
7/24/96	FSP003		1368	
7/18/96	FSP004	2509		
7/18/96	FSP004	2482		
7/18/96	FSP004		2485	
7/18/96	FSP004		2453	
7/18/96	FSP004	783		
7/18/96	FSP004	893		
7/18/96	FSP004		953	
7/18/96	FSP004		1070	
7/19/96	FSP004	928		
7/19/96	FSP004	838		
7/19/96	FSP004		1020	
7/19/96	FSP004		1119	
7/22/96	FSP004	2470		
7/22/96	FSP004	1421		
7/22/96	FSP004		2045	
7/22/96	FSP004		1500	
7/22/96	FSP004	1948		
7/22/96	FSP004	2190		
7/22/96	FSP004		1275	
7/22/96	FSP004		2700	
7/22/96	FSP004	624		
7/22/96	FSP004	1048		
7/22/96	FSP004		874	

Table 9: Unconfined Compressive Strength (UCS) Test Results

Collection Date	Feedstock Pile Number	Age of Soil-Cement Test Cylinder 3-day UCS (psi)	7-day UCS (psi)	28-day UCS (psi)
7/22/96	FSP004		780	
7/30/96	FSP005	1107		
7/30/96	FSP005	997		
7/30/96	FSP005		1259	
7/30/96	FSP005		1249	
7/27/96	FSP005	1284		
7/27/96	FSP005	1076		
7/27/96	FSP005		1339	
7/27/96	FSP005		1296	
8/1/96	FSP006	2697		
8/1/96	FSP006	1305		
8/1/96	FSP006		1429	
8/1/96	FSP006		1819	
8/2/96	FSP006	1128		
8/2/96	FSP006	1313		
8/2/96	FSP006		961	
8/2/96	FSP006		1131	
8/2/96	FSP006	1882		
8/2/96	FSP006	1991		
8/2/96	FSP006		2341	
8/2/96	FSP006		1797	
8/5/96	FSP006	1058		
8/5/96	FSP006	1003		
8/5/96	FSP006		1358	
8/5/96	FSP006		1198	
8/5/96	FSP006	1658		
8/5/96	FSP006	1276		
8/5/96	FSP006		1349	
8/5/96	FSP006		1487	
8/6/96	FSP006		1703	
8/6/96	FSP006		1969	
8/6/96	FSP006	1539		
8/6/96	FSP006	2073		
8/6/96	FSP006		1801	
8/6/96	FSP006		1911	
8/6/96	FSP007	1828		
8/6/96	FSP007	1161		
8/6/96	FSP007		1703	
8/6/96	FSP007		1969	
8/7/96	FSP007	1198		
8/7/96	FSP007	1098		
8/7/96	FSP007		987	
8/7/96	FSP007		1454	
8/7/96	FSP008	990		
8/7/96	FSP008	928		
8/7/96	FSP008		987	
8/7/96	FSP008		1060	
8/8/96	FSP008	984		
8/8/96	FSP008	1130		
8/8/96	FSP008		1065	

Table 9: Unconfined Compressive Strength (UCS) Test Results

Collection Date	Feedstock Pile Number	Age of Soil-Cement Test Cylinder		
		3-day UCS (psi)	7-day UCS (psi)	28-day UCS (psi)
8/8/96	FSP008		1340	
8/8/96	FSP008	957		
8/8/96	FSP008	1208		
8/8/96	FSP008		1012	
8/8/96	FSP008		1076	
8/9/96	FSP009	1336		
8/9/96	FSP009	1404		
8/9/96	FSP009		1767	
8/9/96	FSP009		2134	
8/9/96	FSP009	1347		
8/9/96	FSP009	1238		
8/9/96	FSP009		1187	
8/9/96	FSP009		1178	
8/10/96	FSP009	781		
8/10/96	FSP009	724		
8/10/96	FSP009		756	
8/10/96	FSP009		846	
8/10/96	FSP009	1135		
8/10/96	FSP009	938		
8/10/96	FSP009		1232	
8/10/96	FSP009		1449	
8/10/96	FSP010	781		
8/10/96	FSP010	724		
8/10/96	FSP010		756	
8/10/96	FSP010		846	
8/12/96	FSP010	1503		
8/12/96	FSP010	1341		
8/12/96	FSP010		1242	
8/12/96	FSP010		907	
8/12/96	FSP010			2087
8/13/96	FSP010	939		
8/13/96	FSP010	929		
8/13/96	FSP010		801	
8/13/96	FSP010		1201	
8/13/96	FSP011	1215		
8/13/96	FSP011	1213		
8/13/96	FSP011		1543	
8/13/96	FSP011		1313	
8/14/96	FSP011	1570		
8/14/96	FSP011	1509		
8/14/96	FSP011		1766	
8/14/96	FSP011		1489	
8/14/96	FSP011			1892
8/16/96	FSP012	1341		
8/16/96	FSP012	1780		
8/16/96	FSP012		1691	
8/16/96	FSP012		2104	
8/16/96	FSP012			2203
8/16/96	FSP012	1321		
8/16/96	FSP012	1559		

Table 9: Unconfined Compressive Strength (UCS) Test Results

Collection Date	Feedstock Pile Number	Age of Soil-Cement Test Cylinder		
		3-day UCS (psi)	7-day UCS (psi)	28-day UCS (psi)
8/16/96	FSP012		1338	
8/16/96	FSP012		1268	
8/17/96	FSP012	1154		
8/17/96	FSP012	948		
8/17/96	FSP012		1168	
8/17/96	FSP012		1190	
8/17/96	FSP012	2388		
8/17/96	FSP012	2327		
8/17/96	FSP012		2468	
8/17/96	FSP012		2450	
8/19/96	FSP013	1530		
8/19/96	FSP013	1366		
8/19/96	FSP013		1332	
8/19/96	FSP013		1841	
8/19/96	FSP013	1259		
8/19/96	FSP013	1147		
8/19/96	FSP013		1917	
8/19/96	FSP013		1580	
8/19/96	FSP013			1627
8/20/96	FSP014	1662		
8/20/96	FSP014	1467		
8/20/96	FSP014		2237	
8/20/96	FSP014		1903	
8/20/96	FSP014	1513		
8/20/96	FSP014	1583		
8/20/96	FSP014		1555	
8/20/96	FSP014		1656	
8/21/96	FSP014	1688		
8/21/96	FSP014	1064		
8/21/96	FSP014		1457	
8/21/96	FSP014		1407	
8/21/96	FSP014			1514
8/21/96	FSP014	1006		
8/21/96	FSP014	997		
8/21/96	FSP014		1402	
8/21/96	FSP014		1185	
8/22/96	FSP015	2002		
8/22/96	FSP015	2029		
8/22/96	FSP015		2330	
8/22/96	FSP015		2282	
8/22/96	FSP015	1813		
8/22/96	FSP015	2322		
8/22/96	FSP015		2425	
8/22/96	FSP015		2261	
8/23/96	FSP015	1181		
8/23/96	FSP015	1246		
8/23/96	FSP015		1480	
8/23/96	FSP015		1505	
8/23/96	FSP015	1135		
8/23/96	FSP015	1227		

Table 9: Unconfined Compressive Strength (UCS) Test Results

Collection Date	Feedstock Pile Number	Age of Soil-Cement Test Cylinder		
		3-day UCS (psi)	7-day UCS (psi)	28-day UCS (psi)
8/23/96	FSP015		1302	
8/23/96	FSP015		1517	
8/23/96	FSP015			1570
8/26/96	FSP016	1275		
8/26/96	FSP016	1158		
8/26/96	FSP016		1158	
8/26/96	FSP016		1213	
8/26/96	FSP016	948		
8/26/96	FSP016	1174		
8/26/96	FSP016		1306	
8/26/96	FSP016		1350	
8/26/96	FSP016			1248
8/27/96	FSP016	1141		
8/27/96	FSP016	1111		
8/27/96	FSP016		1362	
8/27/96	FSP016		1446	
8/27/96	FSP016	900		
8/27/96	FSP016	1010		
8/27/96	FSP016		1171	
8/27/96	FSP016		1109	
8/28/96	FSP016	843		
8/28/96	FSP016	1096		
8/28/96	FSP016		1131	
8/28/96	FSP016		1179	
8/28/96	FSP016			1559
8/28/96	FSP016	1204		
8/28/96	FSP016	1086		
8/28/96	FSP016		1453	
8/28/96	FSP016		1804	
9/7/96	FSP016	1041		
9/7/96	FSP016	1015		
9/7/96	FSP016		1193	
9/7/96	FSP016		1125	
9/9/96	FSP017	1168		
9/9/96	FSP017	1061		
9/9/96	FSP017		1097	
9/9/96	FSP017		1333	
9/9/96	FSP017			1518
9/9/96	FSP017	654		
9/9/96	FSP017	1006		
9/9/96	FSP017		934	
9/9/96	FSP017		800	
9/10/96	FSP017	864		
9/10/96	FSP017	839		
9/10/96	FSP017		1071	
9/10/96	FSP017		807	
9/10/96	FSP018	807		
9/10/96	FSP018	755		
9/10/96	FSP018		693	
9/10/96	FSP018		726	

Table 9: Unconfined Compressive Strength (UCS) Test Results

Collection Date	Feedstock Pile Number	Age of Soil-Cement Test Cylinder		
		3-day UCS (psi)	7-day UCS (psi)	28-day UCS (psi)
9/11/96	FSP018	863		
9/11/96	FSP018	782		
9/11/96	FSP018		994	
9/11/96	FSP018		878	
9/11/96	FSP018			1178
9/11/96	FSP019	818		
9/11/96	FSP019	725		
9/11/96	FSP019		1126	
9/11/96	FSP019		890	
9/13/96	FSP019	669		
9/13/96	FSP019	649		
9/13/96	FSP019		829	
9/13/96	FSP019		1020	
9/13/96	FSP020	881		
9/13/96	FSP020	844		
9/13/96	FSP020		1147	
9/13/96	FSP020		1144	
9/18/96	FSP020	1080		
9/18/96	FSP020	986		
9/18/96	FSP020		1374	
9/18/96	FSP020		1160	
9/18/96	FSP020	897		
9/18/96	FSP020	770		
9/18/96	FSP020		1051	
9/18/96	FSP020		798	
9/19/96	FSP021	1208		
9/19/96	FSP021	1110		
9/19/96	FSP021		1245	
9/19/96	FSP021		1138	
9/19/96	FSP021	649		
9/19/96	FSP021	881		
9/19/96	FSP021		1009	
9/19/96	FSP021		1051	
9/21/96	FSP022	810		
9/21/96	FSP022	769		
9/21/96	FSP022		771	
9/21/96	FSP022		1088	
9/21/96	FSP022	696		
9/21/96	FSP022	777		
9/21/96	FSP022		849	
9/21/96	FSP022		964	
9/23/96	FSP022	838		
9/23/96	FSP022	906		
9/23/96	FSP022		1033	
9/23/96	FSP022		971	
9/23/96	FSP022			1096
9/23/96	FSP022	838		
9/23/96	FSP022	1635		
9/23/96	FSP022		1604	
9/23/96	FSP022		1289	

Table 9: Unconfined Compressive Strength (UCS) Test Results

Collection Date	Feedstock Pile Number	Age of Soil-Cement Test Cylinder 3-day UCS (psi)	7-day UCS (psi)	28-day UCS (psi)
9/24/96	FSP022	1152		
9/24/96	FSP022	1036		
9/24/96	FSP022		1465	
9/24/96	FSP022		1231	
9/24/96	FSP023	847		
9/24/96	FSP023	837		
9/24/96	FSP023		1003	
9/24/96	FSP023		952	
9/25/96	FSP023	1234		
9/25/96	FSP023	1012		
9/25/96	FSP023		1657	
9/25/96	FSP023		1436	
9/25/96	FSP023			1486
9/26/96	FSP024	894		
9/26/96	FSP024	953		
9/26/96	FSP024		1087	
9/26/96	FSP024		1170	
9/26/96	FSP024	1305		
9/26/96	FSP024	1486		
9/26/96	FSP024		1806	
9/26/96	FSP024		1759	
9/27/96	FSP025	922		
9/27/96	FSP025	908		
9/27/96	FSP025		943	
9/27/96	FSP025		1079	
9/27/96	FSP025	790		
9/27/96	FSP025	686		
9/27/96	FSP025		927	
9/27/96	FSP025		959	
9/27/96	FSP025			1026
9/28/96	FSP025	932		
9/28/96	FSP025	840		
9/28/96	FSP025		1297	
9/28/96	FSP025		959	
9/28/96	FSP026	969		
9/28/96	FSP026	854		
9/28/96	FSP026		1025	
9/28/96	FSP026		1038	
9/30/96	FSP026	706		
9/30/96	FSP026	751		
9/30/96	FSP026		815	
9/30/96	FSP026		754	
9/30/96	FSP027	1420		
9/30/96	FSP027	1709		
9/30/96	FSP027		1855	
9/30/96	FSP027		1945	
9/30/96	FSP027			2413
10/1/96	FSP027	855		
10/1/96	FSP027	1119		
10/1/96	FSP027		1415	

Table 9: Unconfined Compressive Strength (UCS) Test Results

Collection Date	Feedstock Pile Number	Age of Soil-Cement Test Cylinder		
		3-day UCS (psi)	7-day UCS (psi)	28-day UCS (psi)
10/1/96	FSP027		1478	
10/1/96	FSP028	789		
10/1/96	FSP028	790		
10/1/96	FSP028		956	
10/1/96	FSP028		1009	
10/2/96	FSP028	829		
10/2/96	FSP028	950		
10/2/96	FSP028		1010	
10/2/96	FSP028		1210	
10/2/96	FSP028			1548
10/2/96	FSP028	967		
10/2/96	FSP028	1024		
10/2/96	FSP028		1247	
10/2/96	FSP028		1439	
10/3/96	FSP029	921		
10/3/96	FSP029	715		
10/3/96	FSP029		753	
10/3/96	FSP029		702	
10/3/96	FSP029	1204		
10/3/96	FSP029	820		
10/3/96	FSP029		1371	
10/3/96	FSP029		1166	
10/7/96	FSP030	1293		
10/7/96	FSP030	1530		
10/7/96	FSP030		1895	
10/7/96	FSP030		641	
10/7/96	FSP030			1981
10/8/96	FSP030	1003		
10/8/96	FSP030	950		
10/8/96	FSP030		1202	
10/8/96	FSP030		1119	
10/8/96	FSP031	1303		
10/8/96	FSP031	1123		
10/8/96	FSP031		1483	
10/8/96	FSP031		1215	
10/9/96	FSP032	726		
10/9/96	FSP032	2706		
10/9/96	FSP032		714	
10/9/96	FSP032		880	
10/9/96	FSP032			1074
10/10/96	FSP032	553		
10/10/96	FSP032	736		
10/10/96	FSP032		892	
10/10/96	FSP032		839	
10/10/96	FSP033	610		
10/10/96	FSP033	664		
10/10/96	FSP033		867	
10/10/96	FSP033		743	
10/11/96	FSP033	1063		
10/11/96	FSP033	1073		

Table 9: Unconfined Compressive Strength (UCS) Test Results

Collection Date	Feedstock Pile Number	Age of Soil-Cement Test Cylinder		
		3-day UCS (psi)	7-day UCS (psi)	28-day UCS (psi)
10/11/96	FSP033		1187	
10/11/96	FSP033		1262	
10/11/96	FSP033			1689
10/11/96	FSP033	905		
10/11/96	FSP033	957		
10/11/96	FSP033		1131	
10/11/96	FSP033		1188	
10/12/96	FSP034	856		
10/12/96	FSP034	886		
10/12/96	FSP034		1055	
10/12/96	FSP034		868	
10/14/96	FSP034	870		
10/14/96	FSP034	852		
10/14/96	FSP034		1061	
10/14/96	FSP034		1089	
10/14/96	FSP034			1197
10/14/96	FSP034	721		
10/14/96	FSP034	708		
10/14/96	FSP034		887	
10/14/96	FSP034		773	
10/15/96	FSP035	1752		
10/15/96	FSP035	1429		
10/15/96	FSP035		1526	
10/15/96	FSP035		1874	
10/15/96	FSP035	761		
10/15/96	FSP035	740		
10/15/96	FSP035		827	
10/15/96	FSP035		818	
10/16/96	FSP035	1511		
10/16/96	FSP035	1700		
10/16/96	FSP035		1788	
10/16/96	FSP035		2030	
10/16/96	FSP035			2497
10/16/96	FSP035	1330		
10/16/96	FSP035	1370		
10/16/96	FSP035			2030
10/16/96	FSP035			1529
10/17/96	FSP036	764		
10/17/96	FSP036	858		
10/17/96	FSP036		1216	
10/17/96	FSP036		931	
10/17/96	FSP036	796		
10/17/96	FSP036	856		
10/17/96	FSP036		789	
10/17/96	FSP036		990	
10/18/96	FSP037	625		
10/18/96	FSP037	549		
10/18/96	FSP037		694	
10/18/96	FSP037		679***	
10/18/96	FSP037			875

Table 9: Unconfined Compressive Strength (UCS) Test Results

Collection Date	Feedstock Pile Number	Age of Soil-Cement Test Cylinder		
		3-day UCS (psi)	7-day UCS (psi)	28-day UCS (psi)
10/18/96	FSP037	1580		
10/18/96	FSP037	1669		
10/18/96	FSP037		1765	
10/18/96	FSP037		1891***	
10/19/96	FSP037	701		
10/19/96	FSP037	735		
10/19/96	FSP037		929**	
10/19/96	FSP037		924**	
10/19/96	FSP037			1052
10/19/96	FSP038	713		
10/19/96	FSP038	750		
10/19/96	FSP038		842**	
10/19/96	FSP038		931**	
10/21/96	FSP038	790		
10/21/96	FSP038	832		
10/21/96	FSP038		968	
10/21/96	FSP038		1069	
10/21/96	FSP038			1566
10/22/96	FSP038	775		
10/22/96	FSP038	644		
10/22/96	FSP038		888	
10/22/96	FSP038		885	
10/23/96	FSP039	758		
10/23/96	FSP039	719		
10/23/96	FSP039		938	
10/23/96	FSP039		914	
10/26/96	FSP039			1076
10/23/96	FSP039	757		
10/23/96	FSP039	724		
10/23/96	FSP039		926	
10/23/96	FSP039		938	
10/25/96	FSP039	708		
10/25/96	FSP039	1036		
10/25/96	FSP039		889	
10/25/96	FSP039		1270	
10/25/96	FSP039			1567
10/25/96	FSP040	963		
10/25/96	FSP040	993		
10/25/96	FSP040		1057	
10/25/96	FSP040		1353	
10/28/96	FSP040	922		
10/28/96	FSP040	1035		
10/28/96	FSP040		1163	
10/28/96	FSP040		1281	
10/28/96	FSP040	703		
10/28/96	FSP040	650		
10/28/96	FSP040		871	
10/28/96	FSP040		903	
10/28/96	FSP040			1152
10/30/96	FSP040	878		

Table 9: Unconfined Compressive Strength (UCS) Test Results

Collection Date	Feedstock Pile Number	Age of Soil-Cement Test Cylinder		
		3-day UCS (psi)	7-day UCS (psi)	28-day UCS (psi)
10/30/96	FSP040	947		
10/30/96	FSP040		1024	
10/30/96	FSP040		1219	
10/30/96	FSP040			1317
10/30/96	FSP040	775		
10/30/96	FSP040	798		
10/30/96	FSP040		1115	
10/30/96	FSP040		991	
11/1/96	FSP041	777		
11/1/96	FSP041	808		
11/1/96	FSP041		1188	
11/1/96	FSP041		1033	
11/1/96	FSP041			1154
11/2/96	FSP042	800		
11/2/96	FSP042	802		
11/2/96	FSP042		809	
11/2/96	FSP042		920	
11/2/96	FSP042	586		
11/2/96	FSP042	738		
11/2/96	FSP042		886	
11/2/96	FSP042		837	
11/4/96	FSP042	863		
11/4/96	FSP042	835		
11/4/96	FSP042		1072	
11/4/96	FSP042		1103	
11/4/96	FSP043	662		
11/4/96	FSP043	763		
11/4/96	FSP043		814	
11/4/96	FSP043		995	
11/4/96	FSP043			1331
11/5/96	FSP044	675		
11/5/96	FSP044	727		
11/5/96	FSP044		1050	
11/5/96	FSP044		960	
11/5/96	FSP044	763		
11/5/96	FSP044	884		
11/5/96	FSP044		905	
11/5/96	FSP044		929	
11/6/96	FSP044	657		
11/6/96	FSP044	710		
11/6/96	FSP044		802	
11/6/96	FSP044		1007	
11/6/96	FSP044			1263
11/7/96	FSP045	511		
11/7/96	FSP045	522		
11/7/96	FSP045		680	
11/7/96	FSP045		621	
11/8/96	FSP045	528		
11/8/96	FSP045	634		
11/8/96	FSP045		850	

Table 9: Unconfined Compressive Strength (UCS) Test Results

Collection Date	Feedstock Pile Number	Age of Soil-Cement Test Cylinder		
		3-day UCS (psi)	7-day UCS (psi)	28-day UCS (psi)
11/8/96	FSP045		869	
11/8/96	FSP045			1225
11/9/96	FSP045	909		
11/9/96	FSP045	1038		
11/9/96	FSP045		875	
11/9/96	FSP045		1222	
11/9/96	FSP046	693		
11/9/96	FSP046	609		
11/9/96	FSP046		780	
11/9/96	FSP046		833	
11/11/96	FSP046	593		
11/11/96	FSP046	690		
11/11/96	FSP046		806	
11/11/96	FSP046		905	
11/11/96	FSP046			1477
11/11/96	FSP046	918		
11/11/96	FSP046	870		
11/11/96	FSP046		1209	
11/11/96	FSP046		1188	
11/12/96	FSP046	870		
11/12/96	FSP046	891		
11/12/96	FSP046		1353	
11/12/96	FSP046		1097	
11/12/96	FSP047	766		
11/12/96	FSP047	764		
11/12/96	FSP047		895	
11/12/96	FSP047		973	
11/13/96	FSP047	****		
11/14/96	FSP047	690		
11/14/96	FSP047	484		
11/14/96	FSP047		898	
11/14/96	FSP047		1027	
11/22/96	FSP048	988		
11/22/96	FSP048	1018		
11/22/96	FSP048		966	
11/22/96	FSP048		1076	
11/22/96	FSP048			1644
11/22/96	FSP048	1034		
11/22/96	FSP048	877		
11/22/96	FSP048		1167	
11/22/96	FSP048		1151	
11/21/96	FSP049	713		
11/21/96	FSP049	754		
11/21/96	FSP049		902	
11/21/96	FSP049		1026	
11/21/96	FSP049	746		
11/21/96	FSP049	791		
11/21/96	FSP049		995	
11/21/96	FSP049		993	
11/25/96	FSP050	604		

Table 9: Unconfined Compressive Strength (UCS) Test Results

Collection Date	Feedstock Pile Number	Age of Soil-Cement Test Cylinder		
		3-day UCS (psi)	7-day UCS (psi)	28-day UCS (psi)
11/25/96	FSP050	652		
11/25/96	FSP050		791	
11/25/96	FSP050		878	
11/25/96	FSP050			1266
11/25/96	FSP050	788		
11/25/96	FSP050	687		
11/25/96	FSP050		951	
11/25/96	FSP050		973	
11/26/96	FSP051	713		
11/26/96	FSP051	727		
11/26/96	FSP051		861	
11/26/96	FSP051		925	
11/26/96	FSP051	808		
11/26/96	FSP051	738		
11/26/96	FSP051		978	
11/26/96	FSP051		1179	
12/2/96	FSP051	639		
12/2/96	FSP051	866		
12/2/96	FSP051		1259	
12/2/96	FSP051		1160	
12/2/96	FSP051			1489
12/3/96	FSP051	730		
12/3/96	FSP051	810		
12/3/96	FSP051		924	
12/3/96	FSP051		1104	
12/3/96	FSP051	779		
12/3/96	FSP051	932		
12/3/96	FSP051		1095	
12/3/96	FSP051		983	
12/5/96	FSP052	624		
12/5/96	FSP052	739		
12/5/96	FSP052		832	
12/5/96	FSP052		1001	
12/5/96	FSP052	607		
12/5/96	FSP052	554		
12/5/96	FSP052		720	
12/5/96	FSP052		836	
12/6/96	FSP053	483		
12/6/96	FSP053	502		
12/6/96	FSP053		652	
12/6/96	FSP053		662	
12/6/96	FSP053	583		
12/6/96	FSP053	577		
12/6/96	FSP053		705	
12/6/96	FSP053		620	
12/6/96	FSP053			964
12/7/96	FSP053	510		
12/7/96	FSP053	567		
12/7/96	FSP053		674	
12/7/96	FSP053		722	

Table 9: Unconfined Compressive Strength (UCS) Test Results

Collection Date	Feedstock Pile Number	Age of Soil-Cement Test Cylinder 3-day UCS (psi)	7-day UCS (psi)	28-day UCS (psi)
12/7/96	FSP053	586		
12/7/96	FSP053	617		
12/7/96	FSP053		793	
12/7/96	FSP053		789	
12/9/96	FSP053	593		
12/9/96	FSP053	545		
12/9/96	FSP053		724	
12/9/96	FSP053		617	
12/9/96	FSP053	605		
12/9/96	FSP053	532		
12/9/96	FSP053		727	
12/9/96	FSP053		761	
12/9/96	FSP053			1013
12/10/96	FSP054	761		
12/10/96	FSP054	687		
12/10/96	FSP054		874	
12/10/96	FSP054		1010	
12/10/96	FSP054	698		
12/10/96	FSP054	656		
12/10/96	FSP054		917	
12/10/96	FSP054		883	
12/11/96	FSP055	837		
12/11/96	FSP055	922		
12/11/96	FSP055		970	
12/11/96	FSP055		1174	
12/11/96	FSP055			1359
12/11/96	FSP055	1075		
12/11/96	FSP055	1084		
12/11/96	FSP055		1080	
12/11/96	FSP055		997	
12/12/96	FSP055	720		
12/12/96	FSP055	913		
12/12/96	FSP055		1011	
12/12/96	FSP055		1051	
12/12/96	FSP055	942		
12/12/96	FSP055	1012		
12/12/96	FSP055		1338	
12/12/96	FSP055		1233	
12/13/96	FSP055	888		
12/13/96	FSP055	770		
12/13/96	FSP055		930	
12/13/96	FSP055		1023	
12/13/96	FSP055			1352
12/13/96	FSP056	959		
12/13/96	FSP056	882		
12/13/96	FSP056		1153	
12/13/96	FSP056		1152	
12/14/96	FSP056	650		
12/14/96	FSP056	765		
12/14/96	FSP056		935	

Table 9: Unconfined Compressive Strength (UCS) Test Results

Collection Date	Feedstock Pile Number	Age of Soil-Cement Test Cylinder 3-day UCS (psi)	7-day UCS (psi)	28-day UCS (psi)
12/14/96	FSP056		882	
12/16/96	FSP057	519		
12/16/96	FSP057	663		
12/16/96	FSP057		838	
12/16/96	FSP057		822	
12/16/96	FSP057			1541
1/20/97	FSP058	455		
1/20/97	FSP058	419		
1/20/97	FSP058		658	
1/20/97	FSP058		565	
1/20/97	FSP058			905
1/20/97	FSP058	529		
1/20/97	FSP058	534		
1/20/97	FSP058		785	
1/20/97	FSP058		665	
1/21/97	FSP059	642		
1/21/97	FSP059	683		
1/21/97	FSP059		857	
1/21/97	FSP059		846	
1/21/97	FSP059	570		
1/21/97	FSP059	638		
1/21/97	FSP059		799	
1/21/97	FSP059		847	
5/21/97	60	484.1, 568.7	870.4, 976.3	894.7
5/23/97	62	884.0, 876.0, 876.0, 894.0	762.3, 869.0, 719.0, 769.0	
5/16/97	61	851.8, 777.8,	781.1, 781.0	1165.7
5/19/97	61	432.0, 433.0	2613.0, 2693.0	935.2
5/20/97	62	657.0, 723.0	1246.0, 1107.0	
5/27/97	62	978.8, 1379.0, 570.8, 530.4	2096.8, 1562.9,573.9, 673.8	
5/28/97	62	686.3, 729.4, 1042.6, 803.5	879.9, 974.2, 716.6, 1270.4	1344.6, 805.4
6/3/97	63	843.0, 887.0, 1264.0, 1416.0	1022.0, 1016.6, 1661.9, 1596.8	
6/4/97	63	840.7, 798.7, 985.8, 984.2	956.3, 1037.8, 1127.4, 1125.5	1115.3
6/5/97	63	919.0, 911.6	940.8, 971.5	
6/5/97	64	589.4, 657.7	708.4, 843.7	
6/6/97	64	802.4, 812.6, 1379.3, 1186.3	702.8, 840.6, 1182.7, 1505.5	1212.4
6/17/97	64	752.8, 676.1	934.3, 1090.7	
6/18/97	66	1009.5, 933.7, 735.4, 784.5	1138.0, 1026.8, 830.2, 736.6	1584.3
6/19/97	66	838.6, 835.2	893.7, 921.8	
6/20/97	67	507.1, 632.9	771.1, 753.4	
6/20/97	67	892.5, 800.3	897.5, 942.9	948.7
6/24/97	68	822.4, 796.7, 838.1, 863.8	943.1, 985.8, 879.1, 989.0	1146.5
6/30/97	69B	915.1, 949.7	1096.4, 1108.5	
6/30/97	69B	1788.0, 1572.1, 730.7, 751.4	1867.0, 1842.8	1760.5
7/1/97	69B		834.5, 936.9	
7/1/97	70	949.4, 911.3	1128.4, 946.9	
7/2/97	70	998.4, 996.0, 798.9, 737.2	1011.1, 1049.6, 893.0, 847.1	1191.6
7/3/97	70	1129.3, 1191.0	983.5, 1023.0	
7/3/97	71	1100.2, 813.8	922.5, 722.1	
7/7/97	71	1824.3, 1818.8	2442.9, 2239.0	
7/7/97	72	915.8, 947.7	1071.0, 1539.8	1372.6

Table 9: Unconfined Compressive Strength (UCS) Test Results

Collection Date	Feedstock Pile Number	Age of Soil-Cement Test Cylinder		
		3-day UCS (psi)	7-day UCS (psi)	28-day UCS (psi)
7/8/97	72	755.3, 762.8	1107.0, 913.3	
7/8/97	73	722.1, 621.3	981.1, 870.3	
7/10/97	74	951.7, 957.9, 795.1, 866.6	1139.1, 1131.5, 759.3, 913.0	
7/11/97	74	1284.8, 1540.6	1547.0, 1444.2	1440.6
7/11/97	75	760.3, 687.8	810.2, 867.0	
7/14/97	75		818.4, 842.3	775.5, 716.0
7/24/97	76		739.3, 722.2, 728.0, 726.0	
7/24/97	76		722.7, 744.5, 649.0. 752.6	
7/25/97	76	875.8, 814.6, 877.9, 778.5	840.3, 869.9, 763.2, 762.3	1148.9
7/31/97	77	771.7, 794.5, 916.2, 916.7	1026.8, 1029.2, 1059.3, 1110.3	
8/8/97	77	841.5, 862.5	801.1, 886.4	
8/8/97	78	741.5, 767.5	722.7, 815.9	1169.8
8/11/97	78	520.9, 563.9, 1192.3, 1224.2	804.4, 854.3, 1376.6, 1489.0	2221.9
8/13/97	78	494.1, 532.7	859.3, 670.4	1134.9
8/13/97	79	1672.4, 1520.8	2036.2, 1875.7	
8/15/97	79	1551.5, 1316.3, 1173.8, 1223.	1768.9, 1734.1, 1356.4, 1266.6	988.9
8/18/97	79	500.0, 487.0, 628.3, 591.8	737.1, 785.2, 804.2, 861.4	1184.1
8/21/97	79	667.5, 705.2	837.0, 835.6	
8/21/97	80	782.9, 695.6	746.5, 863.8	
8/22/97	80	789.3, 783.6, 997.7, 777.4	846.3, 951.8, 1201.1, 1066.6	
8/25/97	81	813.4, 704.6, 1143.4, 1026.1	1089.6, 1096.1, 1472.0, 1274.5	1137.6
8/26/97	81	857.2, 788.4, 882.9, 884.5	944.4, 908.9, 1170.7, 1118.8	
8/28/97	82	930.6, 977.9, 943.7, 944.4	840.0, 812.6, 794.0, 862.3	
8/29/97	82	623.7, 512.6, 925.4, 793.2	577.2, 551.4, 624.2, 784.5	796
9/2/97	82	639.2, 662.9, 744.5, 784.2	764.0, 742.7, 917.7, 988.1	
9/3/97	83	809.8, 835.2, 510.6, 524.5	1196.5, 1240.8, 770.1, 849.8	1061.7
9/4/97	83	1210.1, 1184.1	1438.8, 1397.0	
9/4/97	84	678.2, 743.9	884.3, 896.9	
9/5/97	84	804.9, 675.6, 984.9, 1029.2	830.3, 877.3, 1155.1, 1095.2	994.5
9/19/97	85	763.9, 796.9, 1058.7, 933.7	649.4, 782.4, 994.5, 787.3	1152.7
9/22/97	85	655.9, 715.0	886.8, 1039.6	1383.4
10/1/97	85	675.1, 594.3, 930.3, 879.7	769.8, 838.5, 1087.6, 1169.8	948.7
10/14/97	85	876.3, 763.3	879.6, 797.5	
10/16/97	85	768.7, 816.5	949.4, 996.0	
9/24/97	86	892.5, 1007.1, 950.2, 881.4	834.4, 903.3, 887.6, 1026.8	1324.4
9/25/97	86	700.2, 706.9, 702.8, 769.2	715.4, 711.6, 842.4, 792.9	
9/29/97	86	797.2, 1012.7, 982.6, 955.9	991.3, 1041.0, 1170.1, 954.1	1471.2
9/30/97	87	896.3, 961.4, 773.6, 858.4	981.1, 1045.6, 828.1, 942.5	
10/16/97	87	1056.8, 903.7	1332.0, 1061.5	
10/17/97	87	868.2, 985.0, 1136.1, 1091.7	1016.6, 1033.9, 1239.5, 1334.6	1634
10/22/97	87	834.8, 911.5, 873.6, 964.4	1012.7, 1035.5, 1101.7, 1009.5	1268.3
10/24/97	87	515.0, 553.3	817.7, 772.9	1119.4
10/29/97	87	729.4, 823.2	882.2, 841.3	1173.9
10/30/97	87	764.0, 778.4	919.6, 970.8	
10/30/97	88	961.4, 968.5	1340.2, 1250.2	
10/31/97	88	719.7, 762.4	922.9, 1081.0	1310
11/5/97	88	1618.1, 1592.6	1494.9, 1464.2	1620
11/6/97	88	1196.4, 1135.3	1157.4, 1212.1	
11/13/97	88	1771.8, 2201.3	2248.8, 2359.0	

Table 9: Unconfined Compressive Strength (UCS) Test Results

Collection Date	Feedstock Pile Number	Age of Soil-Cement Test Cylinder		
		3-day UCS (psi)	7-day UCS (psi)	28-day UCS (psi)
Notes:				

psi = pounds per square inch

* Soil-cement test cylinder was broken in 5-days

** Soil-cement test cylinder was broken in 6-days

*** Soil-cement test cylinder was broken in 8-days

****Less than one-hour of production, pugmill down before samples obtained

Table 10: Summary of S/S Material Cylinder Leachability Test Results

Sample ID	Date Collected	Production Days Covered[(1)]	TCLP Metals[(2)] Arsenic (mg/l)	Lead (mg/l)	Selenium (mg/l)	Radionuclides[(3)] Uranium (mg/l)	Radium-226 (pCi/l)	Thorium-230 (pCi/l)
Acceptance Criteria	-	-	5.0	5.0	1.0	0.44	5.0	60.0
FSP001-PRE-1	7/11/96	7/1/96 to 7/24/96	<0.05	<0.05	<0.05	<0.005	13.0 +/- 4.2	1.1 +/- 0.7
FSP001-PRE-1	7/11/96[(4)]	7/1/96 to 7/24/96	<1.0	<1.0	<1.0	<0.005	3.4 +/- 1.8	0.4 +/- 0.2
FSP002-PRE-1	7/27/96	7/25/96 to 8/8/96	<1.0	<1.0	<1.0	<0.005	2.9 +/- 1.7	0.3 +/- 0.2
FSP009-PRE-2	8/19/96	8/9/96 to 8/21/96	<1.0	<1.0	<1.0	<0.005	4.1 +/- 2.0	0.3 +/- 0.2
FSP015-PRE-1	8/22/96	8/22/96 to 9/13/96	<0.05	<0.05	<0.05	<0.005	-0.8 +/- 1.2[(5)]	0.2 +/- 0.2
FSP015-PRE-2	8/22/96	8/22/96 to 9/13/96	<0.05	<0.05	<0.05	<0.005	1.9 +/- 0.9	0.1 +/- 0.1
FSP020-PRE-1	9/18/96	9/18/96 to 9/30/96	<0.05	<0.05	<0.05	<0.005	2.2 +/- 0.8	0.2 +/- 0.1
FSP014-PRE-2	9/21/96	9/18/96 to 9/30/96	<0.05	<0.05	<0.05	<0.005	1.5 +/- 0.7	-0.1 +/- 0.1[(5)]
FSP027-PRE 1	10/1/96	10/1/96 to 10/14/96	<0.05	<0.05	<0.05	<0.005	2.9 +/- 1.1	0.3 +/- 0.2
FSP035-PRE-2	10/15/96	10/15/96 to 10/28/96	<0.05	<0.05	<0.05	<0.005	2.3 +/- 2.2	-0.1 +/- 0.2[(5)]
FSP040-PRE-1	10/30/96	10/30/96 to 11/11/96	<0.05	<0.05	<0.05	<0.005	3.6 +/- 1.2	0.0 +/- 0.1
FSP047-PRE-2	11/12/96	11/12/96 to 12/6/96	<0.05	<0.05	<0.05	<0.005	0.6 +/- 0.4	0.0 +/- 0.2
FSP053-PRE-1	12/7/96	12/7/96 to 1/21/97	<0.05	<0.05	<0.05	<0.005	3.7 +/- 1.2	0.1 +/- 0.2
60	5/21/97	5/15/97 to 6/4/97	<0.05	<0.05	<0.05	<0.005	3.3 +/- 0.0	0.2 +/- 0.2
66	6/20/97	6/5/97 to 7/2/97	<0.05	<0.05	<0.05	<0.005	3.6 +/- 1.2	0.0 +/- 0.2
74	7/14/97	7/3/97 to 8/8/97	<0.05	<0.05	<0.05	<0.005	3.2 +/- 1.1	0.0 +/- 0.3
79	8/15/97	8/11/97 to 8/29/97	<0.05	<0.05	<0.05	<0.005	1.9 +/- 0.8	0.0 +/- 0.1
84	9/5/97	9/2/97 to 9/30/97	<0.05	<0.05	<0.05	<0.005	3.8 +/- 1.3	0.3 +/- 0.2
85	10/14/97	10/1/97 to 11/5/97	<0.05	<0.05	<0.05	<0.005	2.3 +/- 0.8	0.7 +/- 0.4

(1) 10 production days (versus 10 calendar days) are covered

(2) Acceptance Criteria based on RCRA maximum concentrations (40 CFR 261.24), Analytical Methods 1311 and 6010

(3) Acceptance Criteria based on groundwater ARAR's from Table 3 of Record of Decision (Uranium shown as 30 pCi/l; which is equivalent to 0.44 mg/l))
Uranium - EPA Method 908.1
Radium-226 - EPA Method 903.1
Thorium - USAEC Method

(4) Retest

(5) Below laboratory detection levels, reported as negative value

< means less than the reported detection limit

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Table 11: Construction Quality Control of Solidified/Stabilized Material by Sand Cone Density Test

Monolith Data									Feedstock Pile Data				Monolith Data	
Sandcone Test No.	Feedstock Pile Source Batch No.	Date	Row	Col	Lift No.	Total Density (lb/ft^3) [1]	Moisture Content (%)	Dry Density (lb/ft^3)	Modified Proctor Sample No.	Maximum Dry Density (lb/ft^3)	Optimum Moisture Content (%)	Percent Modified Proctor [2]	Moisture Content Variance (%) [3]	Note
9A-0001	FSP001	07/01/96	R1	C2	L1	140.2	17	119.8	FSP01/7-1-96/1035	124	12	96.6%	5	Pass
9A-0002	FSP001	07/01/96	R2	C3	L1	131.5	12.6	116.8	FSP01/7-1-96/1900	124	12	94.2%	0.6	Pass
9A-0003	FSP001	07/09/96	R1	C5	L1	135.0	18.6	113.8	FSP01/7-9-96/1310	124	12	91.8%	6.6	Pass
9A-0004	FSP001	07/10/96	R2	C6	L1	134.3	18.2	113.6	FSP01/7-10-96/1030	124	12	91.6%	6.2	Pass
9A-0005	FSP001	07/10/96	R1	C10	L1	135.5	15.3	117.5	FSP01/7-10-96/1520	124	12	94.8%	3.3	Pass
9A-0006	FSP001	07/11/96	R3	C8	L1	138.4	19	116.3	FSP01/7-11-96/1025	124	12	93.8%	7	Pass
9A-0007	FSP001	07/11/96	R2	C11	L2	135.9	15.8	117.4	FSP01/7-11-96/1500	124	12	94.7%	3.8	Pass
9A-0008	FSP003	07/16/96	R3	C11	NA	146.5	15.1	127.3	FSP03/7-16-96/1447	131	7.5	97.2%	7.6	Pass
9A-0009	FSP003	07/17/96	R2	C10	NA	139.7	13.1	123.5	FSP03/7-17-96/1135	131	7.5	94.3%	5.6	Pass
9A-0010	FSP003	07/17/96	R3	C11	NA	141.1	13.6	124.2	FSP03/7-17-96/1455	131	7.5	94.8%	6.1	Pass
9A-0011	FSP004	07/17/96	R3	C12	NA	145.2	13.2	128.3	FSP04/7-17-96/1640	133.9	8.5	95.8%	4.7	Pass
9A-0012	FSP004	07/18/96	R1	C12	NA	131.6	14	115.4	FSP04/7-18-96/1700	133.9	8.5	86.2%	5.5	[4]
9A-0013	FSP004	07/18/96	R1	C12	NA	132.3	13.7	116.4	FSP04/7-18-96/1810	133.9	8.5	86.9%	5.2	[4]
9A-0014	FSP004	07/19/96	R2	C11	NA	133.7	15.5	115.8	FSP04/7-19-96/0935	133.9	8.5	86.5%	8.5	[4]
9A-0015	FSP004	07/22/96	R1	C11	L7	136.1	17	116.3	FSP04/7-22-96/0955	131.5	6.5	88.4%	10.5	[4]
9A-0016	FSP004	07/22/96	R2	C12	L6	132.2	11.3	118.8	FSP04/7-22-96/1155	131.5	6.5	90.3%	4.8	Pass
9A-0017	FSP003	07/22/96	R2	C10	NA	133.3	11.9	119.1	FSP04/7-22-96/1620	131	7.5	90.9%	4.4	Pass
9A-0018	FSP003	07/23/96	R2	C7	L6	142.4	12.8	126.2	FSP003-7/11/96-0715	131	7.5	96.3%	5.3	Pass
9A-0019	FSP003	07/23/96	R1	C11	L8	143.8	12.2	128.2	FSP003-7/11/96-0715	131	7.5	97.9%	4.7	Pass
9A-0020	FSP003	07/23/96	R2	C8	L8	143.3	13.3	126.5	FSP003-7/11/96-0715	131	7.5	96.6%	5.8	Pass
9A-0021	FSP003	07/23/96	R3	C9	L1	145.1	12.9	128.5	FSP003-7/11/96-0715	131	7.5	98.1%	5.4	Pass
9A-0022	FSP003	07/24/96	R4	C11	L2	144.4	14.3	126.3	FSP03/7-11-96/0715	131	7.5	96.4%	6.8	Pass
9A-0023	FSP003	07/24/96	R3	C8	L4	134.3	13.6	118.2	FSP03/7-11-96/0715	131	7.5	90.2%	6.1	Pass
9A-0024	FSP003	07/24/96	R3	C6	L4	131.9	14.3	115.4	FSP03/7-11-96/0715	131	7.5	88.1%	6.8	[4]
9A-0025	FSP002	07/24/96	R3	C8	L6	135.7	14.1	118.9	FSP002-SPT-1-7/22-1300	127.8	9.8	93.0%	4.3	Pass
9A-0026	FSP002	07/25/96	R2	C8	L7	142.0	13.9	124.7	FSP002-SPT-1-7/22-1300	127.8	9.8	97.6%	4.1	Pass
9A-0027	FSP002	07/25/96	R1	C11	L9	130.6	11.9	116.7	FSP002-SPT-1-7/22-1300	127.8	9.8	91.3%	2.1	Pass
9A-0028	FSP002	07/25/96	R4	C11	L3	133.9	13.2	118.3	FSP002-SPT-1-7/22-1300	127.8	9.8	92.6%	3.4	Pass
9A-0029	FSP002	07/25/96	R3	C10	L4	128.4	15.9	110.8	FSP002-SPT-1-7/22-1300	127.8	9.8	86.7%	6.1	[4]
9A-0030	FSP002	07/26/96	R4	C12	L1	140.7	14.6	122.8	FSP002-SPT-1-7/22-1300	127.8	9.8	96.1%	4.8	Pass
9A-0031	FSP002	07/26/96	R4	C9	L2/L3	135.0	12.5	120	FSP002-SPT-1-7/22-1300	127.8	9.8	93.9%	2.7	Pass
9A-0032	FSP002	07/27/96	R4	C7	L4	128.7	14	112.9	FSP002-SPT-1-7/22-1300	127.8	9.8	88.3%	4.2	[4]
9A-0033	FSP005	07/27/96	R4	C12	L5	138.2	13.4	121.9	FSP005-SPT-1-7/25-1415	124.8	11	97.7%	2.4	Pass
9A-0034	FSP005	07/27/96	R3	C8	L7	129.0	13.1	114.1	FSP005-SPT-1-7/25-1415	124.8	11	91.4%	2.1	Pass

Table 11: Construction Quality Control of Solidified/Stabilized Material by Sand Cone Density Test

Monolith Data									Feedstock Pile Data				Monolith Data	
Sandcone Test No.	Feedstock Pile Source Batch No.	Date	Row	Col	Lift No.	Total Density (lb/ft^3) [1]	Moisture Content (%)	Dry Density (lb/ft^3)	Modified Proctor Sample No.	Maximum Dry Density (lb/ft^3)	Optimum Moisture Content (%)	Percent Modified Proctor [2]	Moisture Content Variance (%) [3]	Note
9A-0035	FSP005	07/30/96	R5	C11	L1	139.6	15.4	121	FSP005-SPT-1-7/25-1415	124.8	11	97.0%	4.4	Pass
9A-0036	FSP-006	08/01/96	R4	C2	NA	140.2	13.8	123.2	FSP006-SPT-4-7/30-1230	121.6	10.1	101.3%	3.7	Pass
9A-0037	FSP006	08/02/96	R4	C5	L2	136.9	15.5	118.5	FSP006-SPT-4-7/30-1230	121.6	10.1	97.5%	5.4	Pass
9A-0038	FSP006	08/02/96	R2	C2	L4	141.6	14.6	123.6	FSP006-SPT-4-7/30-1230	121.6	10.1	101.6%	4.5	Pass
9A-0039	FSP006	08/02/96	R2	C3	L6	132.8	13.3	117.2	FSP006-SPT-4-7/30-1230	121.6	10.1	96.4%	3.2	Pass
9A-0040	FSP006	08/02/96	R5	C11	L2	134.0	13.2	118.4	FSP006-SPT-4-7/30-1230	121.6	10.1	97.4%	3.1	Pass
9A-0041	FSP006	08/05/96	R5	C2	L3	135.2	15.4	117.2	FSP006-SPT-4-7/30-1230	121.6	10.1	96.4%	5.3	Pass
9A-0042	FSP006	08/05/96	R5	C8	L4	134.9	15.3	117	FSP006-SPT-4-7/30-1230	121.6	10.1	96.2%	5.2	Pass
9A-0043	FSP006	08/05/96	R5	C10	L5	128.5	14.8	111.9	FSP006-SPT-4-7/30-1230	121.6	10.1	92.0%	4.7	Pass
9A-0044	FSP006	08/05/96	R4	C11	L6	127.2	14.1	111.5	FSP006-SPT-4-7/30-1230	121.6	10.1	91.7%	4	Pass
9A-0045	FSP006	08/06/96	R6	C12	L2	132.1	15.9	114	FSP006-SPT-4-7/30-1230	121.6	10.1	93.8%	5.8	Pass
9A-0046	FSP006	08/06/96	R6	C6	L2	127.9	16.5	109.8	FSP006-SPT-4-7/30-1230	121.6	10.1	90.3%	6.4	Pass
9A-0047	FSP007	08/06/96	R5	C2	L2	131.1	13.8	115.2	FSP007-SPT-1-7/31-1400	123.5	13.3	93.3%	0.5	Pass
9A-0048	FSP007	08/06/96	R5	C10	L4	137.9	14	121	FSP007-SPT-2-8/6-1300	123.6	9.9	97.9%	4.1	Pass
9A-0049	FSP007	08/07/96	R5	C11	L6	146.9	16.1	126.5	FSP007-SPT-2-8/6-1300	123.6	9.9	102.3%	6.2	Pass
9A-0050	FSP007	08/07/96	R3	C3	L6	145.3	14.2	127.2	FSP007-SPT-2-8/6-1300	123.6	9.9	102.9%	4.3	Pass
9A-0051	FSP008	08/08/96	R2	C3	L7	146.7	15.8	126.7	FSP008-SPT-1-8/7-0855	122.9	11.5	103.1%	4.3	[4]
9A-0052	FSP008	08/08/96	R2	C3	NA	132.5	14.8	115.4	FSP008-SPT-1-8/7-0855	122.9	11.5	93.9%	3.3	Pass
9A-0053	FSP008	08/08/96	R4	C6	NA	131.7	15.8	113.7	FSP008-SPT-1-8/7-0855	122.9	11.5	92.5%	4.3	Pass
9A-0054	FSP008	08/08/96	R2	C5	NA	134.5	14.8	117.2	FSP008-SPT-1-8/7-0855	122.9	11.5	95.4%	3.3	Pass
9A-0055	FSP008	08/08/96	R4	C4	NA	132.4	14.9	115.2	FSP008-SPT-1-8/7-0855	122.9	11.5	93.7%	3.4	Pass
9A-0056	FSP009	08/09/96	R3	C12	L7	137.0	12.1	122.2	FSP009-SPT-1-8/8-1435	126	11	97.0%	1.1	Pass
9A-0057	FSP009	08/09/96	R2	C2	NA	138.2	13.4	121.9	FSP009-SPT-1-8/8-1435	126	11	96.7%	2.4	Pass
9A-0058	FSP009	08/10/96	R1	C12	L8	147.3	16.1	126.9	FSP009-SPT-1-8/8-1435	126	11	100.7%	5.1	Pass
9A-0059	FSP009	08/10/96	R3	C10	L8	144.3	15	125.5	FSP009-SPT-1-8/8-1435	126	11	99.6%	4	Pass
9A-0060	FSP009	08/10/96	R2	C7	L8	143.9	13.3	127	FSP009-SPT-1-8/8-1435	126	11	100.8%	2.3	Pass
9A-0061	FSP010	08/10/96	R2	C11	L9	146.5	15.3	127.1	FSP010-SPT-1-8/9-1630	125.6	10	101.2%	5.3	Pass
9A-0062	FSP010	08/10/96	R2	C11	L9	131.8	14.2	115.4	FSP010-SPT-1-8/9-1630	125.6	10	91.9%	4.2	Pass
9A-0063	FSP010	08/12/96	R3	C4	L8	137.8	17	117.8	FSP010-SPT-1-8/9-1630	125.6	10	93.8%	7	Pass
9A-0064	FSP010	08/12/96	R4	C10	L9	137.3	14.2	120.2	FSP010-SPT-1-8/9-1630	125.6	10	95.7%	4.2	Pass
9A-0065	FSP010	08/13/96	R4	C11	L10	143.4	14.6	125.1	FSP010-SPT-1-8/9-1630	125.6	10	99.6%	4.6	Pass
9A-0066	FSP010	08/13/96	R2	C9	L10	140.2	14.7	122.2	FSP010-SPT-1-8/9-1630	125.6	10	97.3%	4.7	Pass
9A-0068	FSP010	08/13/96	R2	C5	L10	133.1	13.6	117.2	FSP010-SPT-1-8/9-1630	125.6	10	93.3%	3.6	Pass
9A-0069	FSP011	08/13/96	R2	C4	L10	143.6	14.6	125.3	FSP011-SPT-1-8/12-1400	123.3	11.5	101.6%	3.1	Pass

Table 11: Construction Quality Control of Solidified/Stabilized Material by Sand Cone Density Test

Monolith Data									Feedstock Pile Data				Monolith Data	
Sandcone Test No.	Feedstock Pile Source Batch No.	Date	Row	Col	Lift No.	Total Density (lb/ft^3) [1]	Moisture Content (%)	Dry Density (lb/ft^3)	Modified Proctor Sample No.	Maximum Dry Density (lb/ft^3)	Optimum Moisture Content (%)	Percent Modified Proctor [2]	Moisture Content Variance (%) [3]	Note
9A-0070	FSP011	08/14/96	R1	C12	L11	138.7	15.2	120.4	FSP011-SPT-01-8/12-1400	123.3	11.5	97.6%	3.7	Pass
9A-0071	FSP012	08/14/96	R3	C7	L10	139.5	13.8	122.6	FSP012-SPT-1-8/13-1650	128.3	8.6	95.6%	5.2	Pass
9A-0072	FSP012	08/16/96	R2	C6	L11	139.7	12.6	124.1	FSP012-SPT-1-8/13-1650	128.3	8.6	96.7%	4	Pass
9A-0073	FSP012	08/16/96	R2	C12	L12	145.9	11.8	130.5	FSP012-SPT-1-8/13-1650	128.3	8.6	101.7%	3.2	Pass
9A-0074	FSP012	08/17/96	R3	C6	NA	135.3	12.9	119.8	FSP012-SPT-1-8/13-1650	128.3	8.6	93.4%	4.3	Pass
9A-0075	FSP012	08/17/96	R3	C12	NA	139.5	15.2	121.1	FSP012-SPT-1-8/13-1650	128.3	8.6	94.4%	6.6	Pass
9A-0076	FSP013	08/17/96	R3	C6	NA	140.1	15.7	121.1	FSP013-SPT-1-8/15-1515	126.9	10	95.4%	5.7	Pass
9A-0077	FSP013	08/17/96	R3	C3	NA	142.0	15.7	122.7	FSP013-SPT-1-8/15-1515	126.9	10	96.7%	5.7	Pass
9A-0078	FSP013	08/19/96	R4	C12	NA	138.4	14.2	121.2	FSP013-SPT-1-8/15-1515	126.9	10	95.5%	4.2	Pass
9A-0079	FSP013	08/19/96	R3	C5	NA	134.3	14.2	117.6	FSP013-SPT-1-8/15-1515	126.9	10	92.7%	4.2	Pass
9A-0080	FSP013	08/19/96	R6	C12	L4	147.1	15	127.9	FSP013-SPT-1-8/15-1515	126.9	10	100.7%	5	Pass
9A-0081	FSP013	08/19/96	R6	C3	L2	140.4	15.4	121.7	FSP013-SPT-1-8/15-1515	126.9	10	95.9%	5.4	Pass
9A-0082	FSP014	08/20/96	R6	C12	NA	134.5	14.5	117.5	FSP014-SPT-1-8/19-1100	127.5	9.7	92.2%	4.8	Pass
9A-0083	FSP014	08/20/96	R6	C10	NA	129.4	14.1	113.4	FSP014-SPT-1-8/19-1100	127.5	9.7	88.9%	4.4	[5]
9A-0084	FSP014	08/20/96	R5	C3	L5	128.4	14.6	112	FSP014-SPT-1-8/19-1100	127.5	9.7	87.8%	4.9	[5]
9A-0085	FSP014	08/20/96	R5	C6	L6	125.4	12.4	111.6	FSP014-SPT-1-8/19-1100	127.5	9.7	87.5%	2.7	[5]
9A-0086	FSP014	08/21/96	R5	C3	L6	129.5	15	112.6	FSP014-SPT-1-8/19-1100	127.5	9.7	88.3%	5.3	[4]
9A-0087	FSP014	08/21/96	R5	C12	L7	131.4	14.8	114.5	FSP014-SPT-1-8/19-1100	127.5	9.7	89.8%	5.1	[5]
9A-0088	FSP014	08/21/96	R5	C3	L6	131.3	14.3	114.9	FSP014-SPT-1-8/19-1100	127.5	9.7	90.1%	4.6	Pass
9A-0089	FSP014	08/21/96	R5	C8	L7	131.3	14.2	115	FSP014-SPT-1-8/19-1100	127.5	9.7	90.2%	4.5	Pass
9A-0090	FSP014	08/21/96	R5	C11	L8	124.5	13.4	109.8	FSP014-SPT-1-8/19-1100	127.5	9.7	86.1%	3.7	[4]
9A-0091	FSP015	08/21/96	R4	C7	L8	129.8	14.3	113.6	FSP015-SPT-1-8/20-1430	126.5	10	89.8%	4.3	[5]
9A-0092	FSP015	08/22/96	R5	C12	L9	134.2	12	119.8	FSP015-SPT-1-8/20-1430	126.5	10	94.7%	2	Pass
9A-0093	FSP015	08/22/96	R5	C7	L9	133.2	14.2	116.6	FSP015-SPT-1-8/20-1430	126.5	10	92.2%	2	Pass
9A-0094	FSP015	08/22/96	R4	C6	L11	136.8	14.7	119.3	FSP015-SPT-1-8/20-1430	126.5	10	94.3%	4.7	Pass
9A-0095	FSP015	08/22/96	R3	C10	L12	134.5	13.7	118.3	FSP015-SPT-1-8/20-1430	126.5	10	93.5%	3.7	Pass
9A-0096	FSP015	08/23/96	R3	C11	L13	135.3	14.3	118.4	FSP015-SPT-1-8/20-1430	126.5	10	93.6%	4.3	Pass
9A-0097	FSP015	08/23/96	R4	C5	L13	134.7	14.6	117.5	FSP015-SPT-1-8/20-1430	126.5	10	92.9%	4.6	Pass
9A-0098	FSP015	08/23/96	R3	C10	L14	140.7	14.8	122.6	FSP015-SPT-1-8/20-1430	126.5	10	96.9%	4.8	Pass
9A-0099	FSP015	08/23/96	R3	C9	L15	130.0	13.8	114.2	FSP015-SPT-1-8/20-1430	126.5	10	90.3%	3.8	Pass
9A-0100	FSP016	08/26/96	R7	C6	L2	136.0	14.5	118.8	FSP016-SPT-1-8/22-0700	122.5	13.7	97.6%	0.8	Pass
9A-0101	FSP016	08/26/96	R7	C7	L1	135.0	16.1	116.3	FSP016-SPT-1-8/22-0700	122.5	13.7	94.9%	2.4	Pass
9A-0102	FSP016	08/27/96	R6	C10	L4	143.5	17.4	122.2	FSP016-SPT-1-8/22-0700	122.5	13.7	99.8%	3.7	Pass
9A-0103	FSP016	08/27/96	R6	C13	L5	138.2	17.7	117.4	FSP016-SPT-1-8/22-0700	122.5	13.7	95.8%	4	Pass

Table 11: Construction Quality Control of Solidified/Stabilized Material by Sand Cone Density Test

Monolith Data									Feedstock Pile Data				Monolith Data	
Sandcone Test No.	Feedstock Pile Source Batch No.	Date	Row	Col	Lift No.	Total Density (lb/ft^3) [1]	Moisture Content (%)	Dry Density (lb/ft^3)	Modified Proctor Sample No.	Maximum Dry Density (lb/ft^3)	Optimum Moisture Content (%)	Percent Modified Proctor [2]	Moisture Content Variance (%) [3]	Note
9A-0104	FSP016	08/27/96	R6	C11	L7	143.2	18.6	120.7	FSP016-SPT-1-8/22-0700	122.5	13.7	98.5%	4.9	Pass
9A-0105	FSP016	08/27/96	R6	C8	L7	128.2	18.2	108.5	FSP016-SPT-1-8/26-1645	122.5	13.7	88.6%	4.5	[4]
9A-0106	FSP016	08/27/96	R6	C8	L7	128.2	18.2	108.5	FSP016-SPT-1-8/26-1645	122.5	13.7	88.6%	4.5	[5]
9A-0107	FSP016	08/28/96	R6	C11	L8	135.3	18.1	114.6	FSP016-SPT-1-8/22-0700	122.5	13.7	93.6%	4.4	Pass
9A-0108	FSP016	08/28/96	R5	C9	L9	142.2	16.9	121.6	FSP016-SPT-1-8/22-0700	122.5	13.7	99.3%	3.2	Pass
9A-0110	FSP016	09/07/96	R5	C10	L10	140.0	16.2	120.5	FSP016-SPT-1-8/22-0700	122.5	13.7	98.4%	2.5	Pass
9A-0109	FSP016	09/07/96	R5	C8	L10	138.3	17.7	117.5	FSP016-SPT-1-8/22-0700	122.5	13.7	95.9%	4.0	Pass
9A-0111	FSP017	09/09/96	R5	C12	L11	140.1	16.0	120.8	FSP017-SPT-1-8/26-1645	124.5	13.5	97.0%	2.5	Pass
9A-0112	FSP017	09/09/96	R5	C10	L11	137.0	18.7	115.4	FSP017-SPT-1-8/26-1645	124.5	13.5	92.7%	5.2	Pass
9A-0113	FSP017	09/09/96	R5	C8	L11	134.0	15.5	116.0	FSP017-SPT-1-8/26-1645	124.5	13.5	93.2%	2.0	Pass
9A-0114	FSP017	09/10/96	R5	C13	L12	135.0	17.4	115.0	FSP017-SPT-1-8/26-1645	124.5	13.5	92.4%	3.9	Pass
9A-0115	FSP017	09/10/96	R4	C10	L12	133.4	15.3	115.7	FSP017-SPT-1-8/26-1645	124.5	13.5	92.9%	1.8	Pass
9A-0116	FSP018	09/10/96	R4	C11	L13	132.3	17.7	112.4	FSP018-SPT-1-9/9-1700	124.0	12.8	90.6%	4.9	Pass
9A-0117	FSP018	09/10/96	R5	C7	L13	135.4	17.7	115.0	FSP018-SPT-1-9/9-1700	124.0	12.8	92.7%	4.9	Pass
9A-0118	FSP018	09/11/96	R4	C7	L14	137.5	18.0	116.5	FSP018-SPT-1-9/9-1700	124.0	12.8	94.0%	5.2	Pass
9A-0119	FSP018	09/11/96	R4	C11	L15	143.0	17.5	121.7	FSP018-SPT-1-9/9-1700	124.0	12.8	98.1%	4.7	Pass
9A-0120	FSP019	09/11/96	R4	C12	L16	136.0	15.1	118.2	FSP019-SPT-1-9/10-1715	129.0	10.7	91.6%	4.4	Pass
9A-0121	FSP019	09/11/96	R5	C7	L15	131.7	13.3	116.2	FSP019-SPT-1-9/10-1715	129.0	10.7	90.1%	2.6	Pass
9A-0122	FSP019	09/13/96	R7	C13	L2	136.5	15.7	118.0	FSP019-SPT-1-9/10-1715	129.0	10.7	91.5%	5.0	Pass
9A-0123	FSP019	09/13/96	R7	C10	L3	130.8	15.0	113.7	FSP019-SPT-1-9/10-1715	129.0	10.7	88.1%	4.3	[4]
9A-0124	FSP019	09/13/96	R7	C10	L3	133.6	13.7	117.5	FSP019-SPT-1-9/10-1715	129.0	10.7	91.1%	3.0	Pass
9A-0125	FSP020	09/13/96	R6	C12	NA	130.6	17.2	111.4	FSP020-SPT-1-9/12-1635	122.4	14.3	91.0%	2.9	Pass
9A-0126	FSP020	09/18/96	R5	C2	L1	133.2	16.2	114.6	FSP020-SPT-1-9/12-1635	122.4	14.3	93.6%	1.9	Pass
9A-0127	FSP020	09/18/96	R7	C2	L2	125.0	15.1	108.6	FSP020-SPT-1-9/12-1635	122.4	14.3	88.7%	0.8	[4]
9A-0128	FSP020	09/18/96	R7	C2	L2	125.4	15.3	108.8	FSP020-SPT-1-9/12-1635	122.4	14.3	88.9%	1.0	[4]
9A-0129	FSP020	09/18/96	R6	C12	L6	136.7	17.0	116.8	FSP020-SPT-1-9/12-1635	122.4	14.3	95.4%	2.7	Pass
9A-0130	FSP021	09/19/96	R6	C6	L6	133.6	17.5	113.7	FSP021-SPT-1-9/14-1400	122.9	14.3	92.5%	3.2	Pass
9A-0131	FSP021	09/19/96	R7	C6	L6	123.8	16.4	106.4	FSP021-SPT-1-9/14-1400	122.9	14.3	86.6%	2.1	[4]
9A-0132	FSP021	09/19/96	R7	C6	L6	131.2	15.7	113.4	FSP021-SPT-1-9/14-1400	122.9	14.3	92.3%	1.4	Pass
9A-0133	FSP021	09/19/96	R6	C12	L8	138.6	17.3	118.2	FSP021-SPT-1-9/14-1400	122.9	14.3	96.2%	3.0	Pass
9A-0134	FSP022	09/21/96	R6	C11	L9	135.3	15.8	116.8	FSP022-SPT-1-9/20-0900	123.0	14.0	95.0%	1.8	Pass
9A-0135	FSP022	09/21/96	R6	C6	L9	132.1	17.3	112.6	FSP022-SPT-1-9/20-0900	123.0	14.0	91.5%	3.3	Pass
9A-0136	FSP022	09/21/96	R6	C12	L10	130.8	16.6	112.2	FSP022-SPT-1-9/20-0900	123.0	14.0	91.2%	2.6	Pass
9A-0137	FSP022	09/21/96	R6	C10	L10	134.0	17.5	114.0	FSP022-SPT-1-9/20-0900	123.0	14.0	92.7%	3.5	Pass

Table 11: Construction Quality Control of Solidified/Stabilized Material by Sand Cone Density Test

Monolith Data									Feedstock Pile Data				Monolith Data	
Sandcone Test No.	Feedstock Pile Source Batch No.	Date	Row	Col	Lift No.	Total Density (lb/ft^3) [1]	Moisture Content (%)	Dry Density (lb/ft^3)	Modified Proctor Sample No.	Maximum Dry Density (lb/ft^3)	Optimum Moisture Content (%)	Percent Modified Proctor [2]	Moisture Content Variance (%) [3]	Note
9A-0138	FSP022	09/23/96	R6	C10	L11	133.6	16.1	115.1	FSP022-SPT-1-9/20-0900	123.0	14.0	93.6%	2.1	Pass
9A-0139	FSP022	09/23/96	R6	C5	L11	126.1	15.8	108.9	FSP022-SPT-1-9/20-0900	123.0	14.0	88.5%	1.8	[4]
9A-0140	FSP022	09/23/96	R6	C5	L11	121.3	16.7	103.9	FSP022-SPT-1-9/20-0900	123.0	14.0	84.5%	2.7	[4]
9A-0141	FSP022	09/23/96	R6	C5	L11	132.6	16.8	113.5	FSP022-SPT-1-9/20-0900	123.0	14.0	92.3%	2.8	Pass
9A-0142	FSP022	09/24/96	R6	C12	L12	121.5	16.5	104.3	FSP022-SPT-1-9/20-0900	123.0	14.0	84.8%	2.5	[5]
9A-0143	FSP022	09/24/96	R6	C11	L12	140.0	15.7	121.0	FSP022-SPT-1-9/20-0900	123.0	14.0	98.4%	1.7	Pass
9A-0144	FSP022	09/24/96	R6	C4	L12	118.9	16.6	102.0	FSP022-SPT-1-9/20-0900	123.0	14.0	82.9%	2.6	[6]
9A-0145	FSP023	09/24/96	R6	C10	L13	130.2	17.0	111.3	FSP023-SPT-1-9/21-1500	123.6	12.5	90.0%	4.5	Pass
9A-0146	FSP023	09/24/96	R5	C12	L14	129.7	14.3	113.5	FSP023-SPT-1-9/21-1500	123.6	12.5	91.8%	1.8	Pass
9A-0147	FSP023	09/25/96	R8	C10	L1	128.0	14.1	112.2	FSP023-SPT-1-9/21-1500	123.6	12.5	90.8%	1.6	Pass
9A-0148	FSP023	09/25/96	R8	C7	L1	133.4	14.4	116.6	FSP023-SPT-1-9/21-1500	123.6	12.5	94.3%	1.9	Pass
9A-0149	FSP024	09/26/96	R8	C12	L2	133.4	15.7	115.3	FSP024-SPT-1-9/24-1630	123.3	13.3	93.5%	2.4	Pass
9A-0150	FSP024	09/26/96	R9	C7	L2	131.2	15.8	113.3	FSP024-SPT-1-9/24-1630	123.3	13.3	91.9%	2.5	Pass
9A-0151	FSP024	09/26/96	R9	C5	L2	134.0	17.4	114.1	FSP024-SPT-1-9/24-1630	123.3	13.3	92.5%	4.1	Pass
9A-0152	FSP025	09/27/96	R8	C4	L2	131.3	16.1	113.1	FSP025-SPT-1-9/26-1650	123.8	13.5	91.4%	2.6	Pass
9A-0153	FSP025	09/27/96	R8	C9	L3	138.6	15.0	120.5	FSP025-SPT-1-9/26-1650	123.8	13.5	97.3%	1.5	Pass
9A-0154	FSP025	09/27/96	R9	C9	L3	135.4	15.3	117.4	FSP025-SPT-1-9/26-1400	123.8	13.5	94.8%	1.8	Pass
9A-0155	FSP025	09/28/96	R8	C12	L4	132.9	18.2	112.4	FSP025-SPT-1-9/26-1650	123.8	13.5	90.8%	4.7	Pass
9A-0156	FSP025	09/28/96	R7	C10	L4	135.0	15.3	117.1	FSP025-SPT-1-9/26-1650	123.8	13.5	94.6%	1.8	Pass
9A-0157	FSP026	09/28/96	R8	C4	L4	132.5	15.8	114.4	FSP026-SPT-1-9/27-1645	123.8	13.5	92.4%	2.3	Pass
9A-0158	FSP026	09/28/96	R8	C10	L5	137.2	15.9	118.4	FSP026-SPT-1-9/27-1645	123.8	13.5	95.6%	2.4	Pass
9A-0159	FSP026	09/30/96	R7	C7	L5	131.7	13.6	115.9	FSP026-SPT-1-9/27-1645	123.8	13.5	93.6%	0.1	Pass
9A-0160	FSP026	09/30/96	R7	C12	L6	133.9	16.4	115.0	FSP026-SPT-1-9/27-1745	123.8	13.5	92.9%	2.9	Pass
9A-0161	FSP027	09/30/96	R7	C3	L6	130.9	13.0	115.8	FSP027-SPT-1-9/30-0755	123.1	13.2	94.1%	-0.2	Pass
9A-0162	FSP027	09/30/96	R7	C12	L7	131.0	14.3	114.6	FSP027-SPT-1-9/30-0755	123.1	13.2	93.1%	1.1	Pass
9A-0163	FSP027	10/01/96	R7	C12	L8	127.5	14.9	111.0	FSP027-SPT-1-9/30-0755	123.1	13.2	90.2%	1.7	Pass
9A-0164	FSP028	10/01/96	R7	C7	L8	136.7	17.6	116.2	FSP028-SPT-1-10/1-0900	122.6	13.7	94.8%	3.9	Pass
9A-0165	FSP028	10/01/96	R7	C3	L8	128.7	15.7	111.2	FSP028-SPT-1-10/1-0900	122.6	13.7	90.7%	2.0	Pass
9A-0166	FSP028	10/02/96	R7	C6	L9	133.2	16.5	114.3	FSP028-SPT-1-10/1-0900	122.6	13.7	93.2%	2.8	Pass
9A-0167	FSP028	10/02/96	R7	C11	L10	134.1	14.9	116.7	FSP028-SPT-1-10/1-0900	122.6	13.7	95.2%	1.2	Pass
9A-0168	FSP028	10/02/96	R7	C12	L11	128.7	17.0	110.0	FSP028-SPT-1-10/1-0900	122.6	13.7	89.7%	3.3	[4]
9A-0169	FSP028	10/02/96	R7	C12	L11	135.0	16.6	115.8	FSP028-SPT-1-10/1-0900	122.6	13.7	94.5%	2.9	Pass
9A-0170	FSP028	10/02/96	R6	C9	L12	132.1	16.8	113.1	FSP028-SPT-1-10/1-0900	122.6	13.7	92.3%	3.1	Pass
9A-0171	FSP029	10/03/96	R7	C11	L13	134.9	16.5	115.8	FSP029-SPT-1-10/2-1029	122.5	14.2	94.5%	2.3	Pass

Table 11: Construction Quality Control of Solidified/Stabilized Material by Sand Cone Density Test

Monolith Data									Feedstock Pile Data				Monolith Data	
Sandcone Test No.	Feedstock Pile Source Batch No.	Date	Row	Col	Lift No.	Total Density (lb/ft^3) [1]	Moisture Content (%)	Dry Density (lb/ft^3)	Modified Proctor Sample No.	Maximum Dry Density (lb/ft^3)	Optimum Moisture Content (%)	Percent Modified Proctor [2]	Moisture Content Variance (%) [3]	Note
9A-0172	FSP029	10/03/96	R6	C4	L13	137.0	16.9	117.2	FSP029-SPT-1-10/2-1029	122.5	14.2	95.7%	2.7	Pass
9A-0173	FSP030	10/07/96	R6	C11	L14	128.7	14.3	112.6	FSP030-SPT-1-10/5-1545	123.0	13.0	91.5%	1.3	Pass
9A-0174	FSP030	10/07/96	R7	C8	L14	134.1	15.9	115.7	FSP030-SPT-1-10/5-1545	123.0	13.0	94.1%	2.9	Pass
9A-0175	FSP030	10/08/96	R6	C10	L15	131.2	13.9	115.2	FSP030-SPT-1-10/5-1545	123.0	13.0	93.7%	0.9	Pass
9A-0176	FSP030	10/08/96	R6	C4	L15	138.0	15.4	119.6	FSP030-SPT-1-10/5-1545	123.0	13.0	97.2%	2.4	Pass
9A-0177	FSP031	10/08/96	R6	C10	L16	131.6	15.7	113.7	FSP031-SPT-1-10/8-0830	124.1	10.5	91.6%	5.2	Pass
9A-0178	FSP032	10/09/96	R10	C9	L1	131.3	15.4	113.8	FSP032-SPT-1-10/9-0720	124.5	12.7	91.4%	2.7	Pass
9A-0179	FSP032	10/09/96	R10	C11	L2	128.7	15.0	111.9	FSP032-SPT-1-10/9-0720	124.5	12.7	89.9%	2.3	[6]
9A-0180	FSP032	10/09/96	R10	C11	L2	134.1	15.5	116.1	FSP032-SPT-1-10/9-0720	124.5	12.7	93.3%	2.8	Pass
9A-0181	FSP032	10/10/96	R10	C10	L3	132.3	15.0	115.0	FSP032-SPT-1-10/9-0720	124.5	12.7	92.4%	2.3	Pass
9A-0182	FSP032	10/10/96	R9	C8	L3	134.2	15.2	116.5	FSP032-SPT-1-10/9-0720	124.5	12.7	93.6%	2.5	Pass
9A-0183	FSP033	10/10/96	R9	C12	L4	133.7	14.2	117.1	FSP033-SPT-1-10/10-0955	124.2	12.2	94.3%	2.0	Pass
9A-0184	FSP033	10/11/96	R9	C4	L4	130.2	14.4	113.8	FSP033-SPT-1-10/10-0955	124.2	12.2	91.6%	2.2	Pass
9A-0185	FSP033	10/11/96	R9	C9	L5	133.7	16.1	115.2	FSP033-SPT-1-10/10-0955	124.2	12.2	92.7%	3.9	Pass
9A-0186	FSP034	10/12/96	R8	C12	L6	138.7	15.4	120.2	FSP034-SPT-1-10/11-1100	124.8	11.8	96.3%	3.6	Pass
9A-0187	FSP034	10/12/96	R9	C9	L6	137.4	16.3	118.1	FSP034-SPT-1-10/11-1100	124.8	11.8	94.6%	4.5	Pass
9A-0188	FSP034	10/14/96	R9	C5	L6	132.6	14.6	115.7	FSP034-SPT-1-10/11-1100	124.8	11.8	92.7%	2.8	Pass
9A-0189	FSP034	10/14/96	R8	C11	L7	121.0	12.7	107.4	FSP034-SPT-1-10/11-1100	124.8	11.8	86.1%	0.9	[4]
9A-0190	FSP034	10/14/96	R9	C11	L7	135.1	14.6	117.9	FSP034-SPT-1-10/11-1100	124.8	11.8	94.5%	2.8	Pass
9A-0191	FSP034	10/14/96	R8	C9	L7	136.4	16.2	117.4	FSP034-SPT-1-10/11-1100	124.8	11.8	94.1%	4.4	Pass
9A-0192	FSP035	10/15/96	R9	C12	L8	137.6	14.2	120.5	FSP035-SPT-1-10/14-1500	126.3	9.2	95.4%	5.0	Pass
9A-0193	FSP035	10/15/96	R8	C8	L8	135.8	14.5	118.6	FSP035-SPT-1-10/14-1500	126.3	9.2	93.9%	5.3	Pass
9A-0194	FSP035	10/15/96	R9	C6	L8	134.9	14.3	118.0	FSP035-SPT-1-10/14-1500	126.3	9.2	93.4%	5.1	Pass
9A-0195	FSP035	10/16/96	R8	C12	L9	138.8	13.9	121.9	FSP035-SPT-1-10/14-1500	126.3	9.2	96.5%	4.7	Pass
9A-0196	FSP035	10/16/96	R9	C12	NA	127.7	13.1	112.9	FSP035-SPT-1-10/14-1500	126.3	9.2	89.4%	3.9	[6]
9A-0197	FSP035	10/16/96	R9	C12	L9	133.6	13.1	118.1	FSP035-SPT-1-10/14-1500	126.3	9.2	93.5%	3.9	Pass
9A-0198	FSP036	10/17/96	R9	C5	L9	137.4	16.4	118.0	FSP036-SPT-1-10/15-1100	126.7	11.0	93.1%	5.4	Pass
9A-0199	FSP036	10/17/96	R9	C11	L10	134.6	15.4	116.6	FSP036-SPT-1-10/15-1100	126.7	11.0	92.0%	4.4	Pass
9A-0200	FSP036	10/17/96	R9	C9	L10	132.9	15.3	115.3	FSP036-SPT-1-10/15-1100	126.7	11.0	91.0%	4.3	Pass
9A-0201	FSP037	10/18/96	R8	C12	L11	131.5	18.0	111.4	FSP037-SPT-1-10/17-1145	123.6	13.0	90.1%	5.0	Pass
9A-0202	FSP037	10/18/96	R8	C10	L11	133.6	15.7	115.5	FSP037-SPT-1-10/17-1145	123.6	13.0	93.4%	2.7	Pass
9A-0203	FSP037	10/19/96	R9	C5	L11	141.2	14.4	123.4	FSP037-SPT-1-10/17-1145	123.6	13.0	99.8%	1.4	Pass
9A-0204	FSP037	10/19/96	R9	C10	L12	133.6	17.3	113.9	FSP037-SPT-1-10/17-1145	123.6	13.0	92.2%	4.3	Pass
9A-0205	FSP038	10/19/96	R8	C7	L12	120.4	12.7	106.8	FSP038-SPT-1-10/18-1450	126.0	11.9	84.8%	0.8	[7]

Table 11: Construction Quality Control of Solidified/Stabilized Material by Sand Cone Density Test

Monolith Data									Feedstock Pile Data				Monolith Data	
Sandcone Test No.	Feedstock Pile Source Batch No.	Date	Row	Col	Lift No.	Total Density (lb/ft^3) [1]	Moisture Content (%)	Dry Density (lb/ft^3)	Modified Proctor Sample No.	Maximum Dry Density (lb/ft^3)	Optimum Moisture Content (%)	Percent Modified Proctor [2]	Moisture Content Variance (%) [3]	Note
9A-0206	FSP038	10/19/96	R8	C5	L12	139.3	16.5	119.6	FSP038-SPT-1-10/18-1450	126.0	11.9	95.0%	4.6	Pass
9A-0207	FSP038	10/21/96	R7	C12	NA	133.0	13.1	117.6	FSP038-SPT-1-10/18-1450	126.0	11.9	93.3%	1.2	Pass
9A-0208	FSP038	10/21/96	R9	C9	NA	130.8	15.0	113.7	FSP038-SPT-1-10/18-1450	126.0	11.9	90.2%	3.1	Pass
9A-0209	FSP038	10/22/96	R8	C11	L14	137.6	15.7	118.9	FSP038-SPT-1-10/18-1450	126.0	11.9	94.4%	3.8	Pass
9A-0210	FSP038	10/22/96	R7	C7	L14	137.0	16.2	117.9	FSP038-SPT-1-10/18-1450	126.0	11.9	93.6%	4.3	Pass
9A-0211	FSP039	10/23/96	R5	C8	L14	131.2	15.7	113.4	FSP039-SPT-1-10/21-1730	124.6	12.3	91.0%	3.4	Pass
9A-0212	FSP039	10/23/96	R11	C12	L1	130.5	15.3	113.2	FSP039-SPT-1-10/21-1730	124.6	12.3	90.9%	3.0	Pass
9A-0213	FSP039	10/23/96	R11	C7	L1	135.3	16.6	116.0	FSP039-SPT-1-10/21-1730	124.6	12.3	93.1%	4.3	Pass
9A-0214	FSP040	10/25/96	R11	C7	L2	128.0	15.5	110.8	FSP040-SPT-1-10/23-1630	122.5	13.5	90.4%	2.0	Pass
9A-0215	FSP040	10/28/96	R10	C11	L3	131.6	15.6	113.8	FSP040-SPT-1-10/23-1630	122.5	13.5	92.3%	2.1	Pass
9A-0216	FSP040	10/28/96	R5	C10	L3	126.6	15.5	109.6	FSP040-SPT-1-10/23-1630	122.5	13.5	89.5%	2.0	[6]
9A-0217	FSP040	10/28/96	R5	C10	L3	132.9	15.3	115.3	FSP040-SPT-1-10/23-1630	122.5	13.5	94.1%	1.8	Pass
9A-0218	FSP040	10/30/96	R10	C6	L4	134.4	16.1	115.8	FSP040-SPT-1-10/23-1630	122.5	13.5	94.5%	2.6	Pass
9A-0219	FSP040	10/30/96	R10	C10	L5	135.7	16.6	116.4	FSP040-SPT-1-10/23-1630	122.5	13.5	95.0%	3.1	Pass
9A-0220	FSP041	10/30/96	R10	C12	L6	138.5	15.8	119.6	FSP041-SPT-5-10/28-1530	125.5	11.7	95.3%	4.1	Pass
9A-0221	FSP041	11/01/96	R11	C6	L6	129.3	14.9	112.5	FSP041-SPT-5-10/28-1530	125.5	11.7	89.6%	3.2	[6]
9A-0222	FSP041	11/01/96	R6	C11	L6	131.7	14.1	115.4	FSP041-SPT-5-10/28-1530	125.5	11.7	92.0%	2.4	Pass
9A-0223	FSP041	11/01/96	R10	C8	L7	132.0	15.6	114.2	FSP041-SPT-5-10/28-1530	125.5	11.7	91.0%	3.9	Pass
9A-0223	FSP042	11/02/96	R10	C10	L8	130.4	17.2	111.3	FSP042-SPT-1-10/31-1415	121.5	13.6	90.0%	3.6	Pass
9A-0224	FSP042	11/02/96	R12	C11	L9	128.9	15.5	111.6	FSP042-SPT-1-10/31-1415	121.5	13.6	91.9%	1.9	Pass
9A-0225	FSP042	11/04/96	R10	C12	L9	128.4	13.9	112.7	FSP042-SPT-1-10/31-1415	121.5	13.6	92.8%	0.9	Pass
9A-0226	FSP043	11/04/96	R10	C5	L9	128.0	14.7	111.6	FSP043-SPT-1-11/2-1615	125.0	13.0	89.3%	1.7	[6]
9A-0227	FSP043	11/04/96	R10	C5	L9	130.8	14.1	114.6	FSP043-SPT-1-11/2-1615	125.0	13.0	91.7%	1.1	Pass
9A-0228	FSP043	11/04/96	R10	C7	L10	129.8	13.9	114.0	FSP043-SPT-1-11/2-1615	125.0	13.0	91.2%	0.9	Pass
9A-0229	FSP044	11/05/96	R9	C5	L11	130.1	16.1	112.1	FSP044-SPT-1-11/4-1700	123.0	12.2	91.1%	3.9	Pass
9A-0230	FSP044	11/05/96	R10	C11	L12	130.8	15.3	113.4	FSP044-SPT-1-11/4-1700	123.0	12.2	92.2%	3.1	Pass
9A-0231	FSP044	11/06/96	R10	C7	L13	131.2	16.3	112.8	FSP044-SPT-1-11/4-1700	123.0	12.2	91.7%	4.1	Pass
9A-0232	FSP045	11/07/96	R11	C7	L2	131.8	16.4	113.2	FSP045-SPT-1-11/5-1700	123.0	13.1	92.0%	3.2	Pass
9A-0233	FSP045	11/08/96	R12	C6	L3	130.2	16.0	112.2	FSP045-SPT-1-11/5-1700	123.0	13.1	91.2%	2.9	Pass
9A-0234	FSP045	11/09/96	R11	C5	L4	133.5	15.4	115.7	FSP045-SPT-1-11/5-1700	123.0	13.1	94.1%	2.3	Pass
9A-0235	FSP046	11/09/96	R11	C6	L5	135.7	16.1	116.9	FSP046-SPT-1-11/7-1100	123.5	12.5	94.7%	3.6	Pass
9A-0236	FSP046	11/11/96	R11	C8	L7	131.8	15.9	113.7	FSP046-SPT-1-11/7-1100	123.5	12.5	92.1%	3.4	Pass
9A-0237	FSP046	11/11/96	R12	C7	L8	131.7	15.2	114.3	FSP046-SPT-1-11/7-1100	123.5	12.5	92.6%	2.7	Pass
9A-0238	FSP046	11/11/96	R11	C12	L9	134.6	15.9	116.1	FSP046-SPT-1-11/7-1100	123.5	12.5	94.0%	3.4	Pass

Table 11: Construction Quality Control of Solidified/Stabilized Material by Sand Cone Density Test

Monolith Data									Feedstock Pile Data				Monolith Data	
Sandcone Test No.	Feedstock Pile Source Batch No.	Date	Row	Col	Lift No.	Total Density (lb/ft^3) [1]	Moisture Content (%)	Dry Density (lb/ft^3)	Modified Proctor Sample No.	Maximum Dry Density (lb/ft^3)	Optimum Moisture Content (%)	Percent Modified Proctor [2]	Moisture Content Variance (%) [3]	Note
9A-0239	FSP046	11/12/96	R12	C5	L9	135.1	15.4	117.1	FSP046-SPT-1-11/7-1100	123.5	12.5	94.8%	2.9	Pass
9A-0240	FSP047	11/12/96	R11	C11	L11	132.3	16.8	113.3	FSP047-SPT-1-11/11-1430	124.5	12.2	91.0%	4.6	Pass
9A-0241	FSP047	11/12/96	R11	C9	L12	130.4	15.7	112.7	FSP047-SPT-1-11/11-1430	124.5	12.2	90.5%	3.5	Pass
9A-0242	FSP047	11/13/96	R11	C12	L13	132.3	15.0	115.0	FSP047-SPT-1-11/11-1430	124.5	12.2	92.4%	2.8	Pass
9A-0243	FSP047	11/14/96	R11	C10	L13	127.1	16.2	109.4	FSP047-SPT-1-11/11-1430	124.5	12.2	87.9%	2.2	[6]
9A-0244	FSP047	11/14/96	R11	C10	L13	127.6	15.6	110.4	FSP047-SPT-1-11/11-1430	124.5	12.2	88.7%	3.4	[7]
9A-0245	FSP048	11/22/96	R13	C6	L3	122.9	15.9	106	FSP048-SPT-1-11/13-0830	123.5	12.5	85.8%	3.4	[6]
9A-0246	FSP048	11/22/96	R13	C6	L3	131.3	16.3	112.9	FSP048-SPT-1-11/13-0830	123.5	12.5	91.4%	3.8	Pass
9A-0247	FSP048	11/22/96	R12	C11	L3	143.6	16.4	123.4	FSP048-SPT-1-11/13-0830	123.5	12.5	91.0%	3.9	Pass
9A-0248	FSP049	11/21/96	R13	C12	L1	135.3	17.1	115.5	FSP049-SPT-1-11/18-1600	122.7	13	94.1%	4.2	Pass
9A-0249	FSP049	11/21/96	R13	C9	L2	133.3	14.2	116.7	FSP049-SPT-1-11/18-1600	122.7	13	95.1%	1.2	Pass
9A-0250	FSP050	11/25/96	R12	C9	L5	136.8	15.9	118	FSP050-SPT-1-11/23-1310	124.3	12.5	94.9%	3.4	Pass
9A-0251	FSP050	11/25/96	R12	C11	L7	135.1	16.8	115.7	FSP050-SPT-1-11/23-1310	124.3	12.5	93.1%	4.3	Pass
9A-0252	FSP050	11/25/96	R13	C12	L6	128.5	15.6	111.2	FSP050-SPT-1-11/23-1310	124.3	12.5	89.5%	3.1	[6]
9A-0253	FSP050	11/25/96	R13	C12	L6	133.9	15.3	116.1	FSP050-SPT-1-11/23-1310	124.3	12.5	93.4%	2.8	Pass
9A-0254	FSP051	11/26/96	R12	C10	L8	134.8	15.9	116.3	FSP051-SPT-1-11/25-1345	124.5	12.6	93.4%	3.3	Pass
9A-0255	FSP051	11/26/96	R12	C9	L9	135.4	16.1	116.6	FSP051-SPT-1-11/25-1345	124.5	12.6	93.7%	3.5	Pass
9A-0256	FSP051	12/2/96	R12	C7	L9	136.6	14.1	119.7	FSP051-SPT-1-11/25-1345	124.5	12.6	96.1%	1.5	Pass
9A-0257	FSP051	12/3/96	R12	C10	L10	140.2	15.2	121.7	FSP051-SPT-1-11/25-1345	124.5	12.6	97.8%	2.6	Pass
9A-0258	FSP051	12/3/96	R12	C11	L11	137.7	15.5	119.2	FSP051-SPT-1-11/25-1345	124.5	12.6	95.7%	2.9	Pass
9A-0259	FSP052	12/5/96	R14	C12	L1	133.4	16.3	114.7	FSP052-SPT-1-11/27-1330	119.3	15.4	96.1%	0.9	Pass
9A-0260	FSP052	12/5/96	R14	C9	L2	129.7	17.5	110.4	FSP052-SPT-1-11/27-1330	119.3	15.4	92.5%	2.1	Pass
9A-0261	FSP052	12/5/96	R14	C11	L3	129.8	16	111.9	FSP052-SPT-1-11/27-1330	119.3	15.4	93.8%	0.6	Pass
9A-0262	FSP053	12/6/96	R13	C9	L4	139.2	16.3	119.7	FSP053-SPT-1-12/3-1500	123.5	13	96.9%	3.3	Pass
9A-0263	FSP053	12/6/96	R13	C8	L5	135.3	16.8	115.8	FSP053-SPT-1-12/3-1500	123.5	13	93.2%	3.8	Pass
9A-0264	FSP053	12/6/96	R14	C12	L6	136.3	15.9	117.6	FSP053-SPT-1-12/3-1500	123.5	13	95.2%	2.9	Pass
9A-0265	FSP053	12/7/96	R13	C11	L7	133.4	15.8	115.2	FSP053-SPT-1-12/3-1500	123.5	13	93.3%	2.8	Pass
9A-0266	FSP053	12/7/96	R14	C12	L8	128.8	15	112	FSP053-SPT-1-12/3-1500	123.5	13	90.7%	2	Pass
9A-0267	FSP053	12/7/96	R14	C12	L9	136.2	16.6	116.8	FSP053-SPT-1-12/3-1500	123.5	13	94.6%	3.6	Pass
9A-0268	FSP053	12/9/96	R13	C12	L10	130.8	18.9	110	FSP053-SPT-1-12/3-1500	123.5	13	89.1%	5.9	[4]
9A-0269	FSP053	12/9/96	R13	C12	L10	135.7	16.7	116.3	FSP053-SPT-1-12/3-1500	123.5	13	94.2%	3.7	Pass
9A-0270	FSP053	12/9/96	R13	C7	L10	134.4	16.8	115.1	FSP053-SPT-1-12/3-1500	123.5	13	93.2%	3.8	Pass
9A-0270	FSP053	12/9/96	R13	C10	L12	131.7	17	112.6	FSP053-SPT-1-12/3-1500	123.5	13	91.2%	4	Pass
9A-0271	FSP054	12/10/96	R15	C5	L1	129.2	14.8	112.5	FSP054-SPT-1-12/7-1400	123.3	13.3	91.2%	1.5	Pass

Table 11: Construction Quality Control of Solidified/Stabilized Material by Sand Cone Density Test

Monolith Data									Feedstock Pile Data				Monolith Data	
Sandcone Test No.	Feedstock Pile Source Batch No.	Date	Row	Col	Lift No.	Total Density (lb/ft^3) [1]	Moisture Content (%)	Dry Density (lb/ft^3)	Modified Proctor Sample No.	Maximum Dry Density (lb/ft^3)	Optimum Moisture Content (%)	Percent Modified Proctor [2]	Moisture Content Variance (%) [3]	Note
9A-0272	FSP054	12/10/96	R14	C9	L2	134.0	15.7	115.8	FSP054-SPT-1-12/7-1400	123.3	13.3	93.9%	2.4	Pass
9A-0273	FSP054	12/10/96	R15	C12	L3	129.7	15.9	111.9	FSP054-SPT-1-12/7-1400	123.3	13.3	90.8%	2.6	Pass
9A-0274	FSP055	12/11/96	R15	C6	L4	129.7	15.6	112.2	FSP055-SPT-1-12/10-1420	127	11.7	88.4%	3.9	[6]
9A-0275	FSP055	12/11/96	R15	C6	L4	132.9	14.1	116.5	FSP055-SPT-1-12/10-1420	127	11.7	91.7%	2.4	Pass
9A-0276	FSP055	12/11/96	R15	C9	L5	134.4	14.9	117	FSP055-SPT-1-12/10-1420	127	11.7	92.1%	3.2	Pass
9A-0277	FSP055	12/11/96	R15	C12	L6	135.0	15.8	116.6	FSP055-SPT-1-12/10-1420	127	11.7	91.8%	4.1	Pass
9A-0278	FSP055	12/12/96	R15	C12	L7	130.6	14.3	114.3	FSP055-SPT-1-12/10-1420	127	11.7	90.0%	2.6	Pass
9A-0279	FSP055	12/12/96	R14	C6	L8	130.6	16.2	112.4	FSP055-SPT-1-12/10-1420	127	11.7	88.5%	4.5	[6]
9A-0280	FSP055	12/12/96	R14	C6	L8	134.9	15.8	116.5	FSP055-SPT-1-12/10-1420	127	11.7	91.7%	4.1	Pass
9A-0281	FSP055	12/12/96	R14	C11	L9	133.6	15.8	115.4	FSP055-SPT-1-12/10-1420	127	11.7	90.9%	4.1	Pass
9A-0282	FSP055	12/13/96	R14	C11	L10	138.8	15.9	119.8	FSP055-SPT-1-12/10-1420	127	11.7	94.3%	4.2	Pass
9A-0283	FSP056	12/13/96	R14	C9	L11	135.4	16.6	116.1	FSP056-SPT-1-12/12-1400	122.7	13	94.6%	3.6	Pass
9A-0284	FSP056	12/13/96	R15	C12	L12	135.6	15.3	117.6	FSP056-SPT-1-12/12-1400	122.7	13	95.8%	2.3	Pass
9A-0285	FSP056	12/14/96	R15	C6	L1	134.9	14.5	117.8	FSP056-SPT-1-12/12-1400	122.7	13	96.0%	1.5	Pass
9A-0286	FSP057	12/16/96	R16	C7	L3	134.9	14.8	117.5	FSP057-SPT-1-12/32-1650	123.5	13.5	95.1%	1.3	Pass
9A-0287	FSP058	1/20/97	R16	C12	NA	136.3	12.7	120.9	FSP058-SPT-1-1/18-1200	122.9	12.2	98.4%	0.5	Pass
9A-0288	FSP058	1/20/97	R16	C10	NA	134.6	16.2	115.8	FSP058-SPT-1-1/18-1200	122.9	12.2	94.2%	4	Pass
9A-0289	FSP059	1/21/97	R16	C8	L3	130.1	18.6	109.7	FSP059-SPT-1-1/20-1730	122.5	13.5	89.6%	5.1	[6]
9A-0290	FSP059	1/21/97	R16	C8	NA	135.9	17.8	115.4	FSP059-SPT-1-1/20-1730	122.5	13.5	94.2%	4.3	Pass
9A-0291	FSP059	1/21/97	R16	C11	NA	136.9	16.8	117.2	FSP059-SPT-1-1/20-1730	122.5	13.5	95.7%	3.3	Pass
PLC0516-1	61	5/16/97	16	10	5	131.7	17.9	111.7	FSP061-SPT-1	124.1	12.2	90.1%	5.7	Pass
PLC0516-2	61	5/16/97	17	7	5	134.5	17.5	114.5	FSP061-SPT-1	124.1	12.2	92.3%	5.3	Pass
PLC0519-1	60	5/19/97	16	11	6	134.6	15.7	116.3	FSP060-SPT-1	122.4	12.8	95.0%	2.9	Pass
PLC0520-1	60	5/20/97	15	8	6	131.7	19.4	110.3	FSP060-SPT-1	122.4	12.8	90.1%	6.6	Pass
PLC0520-2	60	5/20/97	15	5	6	132.4	17.3	112.9	FSP060-SPT-1	122.4	12.8	92.2%	4.5	Pass
PLC0521-1	60	5/21/97	15	12	7	129.3	18.2	109.4	FSP060-SPT-1	122.4	12.8	89.4%	5.4	[6]
PLC0521-2	60	5/21/97	15	12	7	133.0	18.4	112.3	FSP060-SPT-1	122.4	12.8	91.7%	5.6	Pass
PLC0521-3	62	5/21/97	17	9	7	134.8	15.0	117.2	FSP062-SPT-1	124.0	11.5	94.5%	3.5	Pass
PLC0523-1	62	5/23/97	15	10	8	133.3	18.3	112.7	FSP062-SPT-1	124.0	11.5	90.9%	6.8	Pass
PLC0523-2	62	5/23/97	17	6	8	133.9	16.7	114.7	FSP062-SPT-1	124.0	11.5	92.5%	5.2	Pass
PLC0527-1	62	5/27/97	16	11	9	132.2	15.4	114.6	FSP062-SPT-1	124.0	11.5	92.4%	3.9	Pass
PLC0527-2	62	5/27/97	17	7	9	133.9	16.0	115.4	FSP062-SPT-1	124.0	11.5	93.1%	4.5	Pass
PLC0528-1	62	5/28/97	17	11	10	131.5	17.6	111.8	FSP062-SPT-1	124.0	11.5	90.2%	6.1	Pass
PLC0528-2	62	5/28/97	16	11	11	132.4	17.2	113.0	FSP062-SPT-1	124.0	11.5	91.1%	5.7	Pass

Table 11: Construction Quality Control of Solidified/Stabilized Material by Sand Cone Density Test

Monolith Data									Feedstock Pile Data				Monolith Data	
Sandcone Test No.	Feedstock Pile Source Batch No.	Date	Row	Col	Lift No.	Total Density (lb/ft^3) [1]	Moisture Content (%)	Dry Density (lb/ft^3)	Modified Proctor Sample No.	Maximum Dry Density (lb/ft^3)	Optimum Moisture Content (%)	Percent Modified Proctor [2]	Moisture Content Variance (%) [3]	Note
PLC0603-1	63	6/3/97	19	10	1	128.5	16.7	110.1	FSP063-SPT-1	121.8	10.0	90.4%	6.7	Pass
PLC0603-2	63	6/3/97	18	6	1	129.8	18.0	110.0	FSP063-SPT-1	121.8	10.0	90.3%	8.0	Pass
PLC0603-3	63	6/3/97	18	11	2	132.1	18.8	111.2	FSP063-SPT-1	121.8	10.0	91.3%	8.8	Pass
PLC0604-1	63	6/4/97	18	6	2	134.2	15.1	116.6	FSP063-SPT-1	121.8	10.0	95.7%	5.1	Pass
PLC0604-2	63	6/4/97	17	10	3	133.2	17.5	113.4	FSP063-SPT-1	121.8	10.0	93.1%	7.5	Pass
PLC0605-1	63	6/5/97	18	10	4	129.5	16.1	111.5	FSP063-SPT-1	121.8	10.0	91.5%	6.1	Pass
PLC0605-2	63	6/5/97	18	10	5	128.6	15.5	111.3	FSP063-SPT-1	121.8	10.0	91.4%	5.5	Pass
PLC0605-3	64	6/5/97	17	8	5	131.0	16.4	112.5	FSP064-SPT-1	122.5	13.0	91.8%	3.4	Pass
PLC0606-1	64	6/6/97	17	11	6	129.5	16.9	110.8	FSP064-SPT-1	122.5	13.0	90.5%	3.9	Pass
PLC0606-2	64	6/6/97	18	8	6	128.0	15.4	110.9	FSP064-SPT-1	122.5	13.0	90.5%	2.4	Pass
PLC0617-1	64	6/17/97	20	12	1	133.9	16.2	115.2	FSP064-SPT-1	122.5	13.0	94.0%	3.2	Pass
PLC0617-2	65	6/17/97	19	12	2	133.4	16.8	114.2	FSP065-SPT-1	122.6	12.4	93.1%	4.4	Pass
PLC0618-1	66	6/18/97	19	12	7	128.7	16.4	110.6	FSP066-SPT-1	121.4	12.0	91.1%	4.4	Pass
PLC0618-2	66	6/18/97	19	7	1	131.5	17.6	111.8	FSP066-SPT-1	121.4	12.0	92.1%	5.6	Pass
PLC0619-1	66	6/19/97	17	8	7	132.7	17.1	113.3	FSP066-SPT-1	121.4	12.0	93.3%	5.1	Pass
PLC0620-1	67	6/20/97	20	12	3	135.1	17.7	114.8	FSP067-SPT-1	120.6	12.0	95.2%	5.7	Pass
PLC0620-2	67	6/20/97	19	6	3	135.7	18.2	114.8	FSP067-SPT-1	120.6	12.0	95.2%	6.2	Pass
PLC0620-3	67	6/20/97	19	13	4	132.9	15.7	114.9	FSP067-SPT-1	120.6	12.0	95.3%	3.7	Pass
PLC0624-1	68	6/24/97	19	7	4	134.3	17.5	114.3	FSP068-SPT-1	122.3	9.4	93.4%	8.1	Pass
PLC0624-2	68	6/24/97	19	11	5	135.6	16.7	116.2	FSP068-SPT-1	122.3	9.4	95.0%	1.3	Pass
PLC0630-1	69B	6/30/97	21	11	6	131.1	18.2	110.9	FSP69B-SPT-1	122.0	10.8	91.0%	7.4	Pass
PLC0630-2	69B	6/30/97	19	12	7	133.6	16.8	114.4	FSP69B-SPT-1	122.0	10.8	93.8%	6.0	Pass
PLC0630-3	69B	6/30/97	20	10	7	132.0	16.9	112.9	FSP69B-SPT-1	122.0	10.8	92.5%	6.1	Pass
PLC0701-1	70	7/1/97	21	7	7	131.9	16.8	112.9	FSP070-SPT-1	122.2	11.5	92.4%	5.3	Pass
PLC0701-2	70	7/1/97	17	10	8	135.5	17.3	115.5	FSP070-SPT-1	122.2	11.5	94.5%	5.8	Pass
PLC0701-3	70	7/1/97	20	12	8	132.6	17.2	113.1	FSP070-SPT-1	122.2	11.5	92.6%	5.7	Pass
PLC0702-1	70	7/2/97	17	12	8	134.7	15.5	116.6	FSP070-SPT-1	122.2	11.5	95.4%	4.0	Pass
PLC0702-2	70	7/2/97	20	11	9	137.2	17.3	117.0	FSP070-SPT-1	122.2	11.5	95.8%	5.8	Pass
PLC0703-1	70	7/3/97	17	11	10	135.1	16.6	115.9	FSP070-SPT-1	122.2	11.5	94.8%	5.1	Pass
PLC0703-2	71	7/3/97	20	9	10	130.1	15.3	112.8	FSP071-SPT-1	122.2	9.1	92.3%	6.2	Pass
PLC0707-1	71	7/7/97	19	6	10	132.9	17.8	112.8	FSP071-SPT-1	122.2	9.1	92.3%	8.7	Pass
PLC0707-2	72	7/7/97	17	10	11	121.3	15.7	104.8	FSP072-SPT-1	121.1	12.7	85.8%	3.0	[6]
PLC0707-3	72	7/7/97	17	10	11	130.8	14.2	114.5	FSP072-SPT-1	121.1	12.7	93.7%	1.5	Pass
PLC0708-1	72	7/8/97	21	7	11	127.5	17.3	108.7	FSP072-SPT-1	121.1	12.7	89.8%	4.6	[6]

Table 11: Construction Quality Control of Solidified/Stabilized Material by Sand Cone Density Test

Monolith Data									Feedstock Pile Data				Monolith Data	
Sandcone Test No.	Feedstock Pile Source Batch No.	Date	Row	Col	Lift No.	Total Density (lb/ft^3) [1]	Moisture Content (%)	Dry Density (lb/ft^3)	Modified Proctor Sample No.	Maximum Dry Density (lb/ft^3)	Optimum Moisture Content (%)	Percent Modified Proctor [2]	Moisture Content Variance (%) [3]	Note
PLC0708-2	72	7/8/97	21	7	11	132.0	16.5	113.3	FSP072-SPT-1	121.1	12.7	93.6%	3.8	Pass
PLC0708-3	73	7/8/97	20	10	12	133.9	16.0	115.4	FSP073-SPT-1	125.5	11.0	91.9%	5.0	Pass
PLC0710-1	74	7/10/97	15	11	12	144.8	15.2	125.7	FSP074-SPT-1	122.2	12.4	102.8%	2.8	Pass
PLC0710-2	74	7/10/97	16	7	12	128.0	15.6	110.7	FSP074-SPT-1	122.2	12.4	90.6%	3.2	Pass
PLC0711-1	74	7/11/97	21	9	13	132.6	15.0	115.3	FSP074-SPT-1	122.2	12.4	94.4%	2.6	Pass
PLC0711-2	75	7/11/97	16	11	13	128.1	15.1	111.3	FSP075-SPT-1	120.5	11.6	92.3%	3.5	Pass
PLC0714-1	75	7/14/97	16	7	13	132.2	16.8	113.2	FSP075-SPT-1	120.5	11.6	93.9%	5.2	Pass
PLC0724-1	76	7/24/97	8	4	14	130.2	14.4	113.8	FSP076-SPT-1	121.6	11.5	93.6%	2.9	Pass
PLC0724-2	76	7/24/97	11	4	13	127.9	12.7	113.5	FSP076-SPT-1	121.6	11.5	93.4%	1.2	Pass
PLC0724-3	76	7/24/97	3	5	15	121.9	11.0	109.8	FSP076-SPT-1	121.6	11.5	90.3%	0.5	Pass
PLC0725-1	76	7/25/97	11	4	14	130.2	13.8	114.4	FSP076-SPT-1	121.6	11.5	94.1%	2.3	Pass
PLC0731-1	77	7/31/97	9	5	15	131.0	15.1	113.8	FSP077-SPT-1	122.5	12.0	92.9%	3.1	Pass
PLC0731-2	77	7/31/97	10	5	16	137.4	14.4	120.1	FSP077-SPT-1	122.5	12.0	98.0%	2.4	Pass
PLC0808-1	77	8/8/97	6	10	16	128.4	15.3	111.4	FSP077-SPT-1	122.5	12.0	90.9%	3.3	Pass
PLC0808-2	78	8/8/97	3	10	17	124.4	12.8	110.3	FSP078-SPT-1	121.9	12.5	90.5%	0.3	Pass
PLC0811-1	78	8/11/97	3	6	17	134.3	15.2	116.6	FSP078-SPT-1	121.9	12.5	95.7%	2.7	Pass
PLC0813-1	78	8/13/97	5	9	18	136.8	17.2	116.7	FSP078-SPT-1	121.9	12.5	95.7%	4.7	Pass
PLC0813-2	78	8/13/97	3	10	19	131.9	14.7	115.0	FSP078-SPT-1	121.9	12.5	94.3%	2.2	Pass
PLC0813-3	79	8/13/97	5	8	16	135.1	14.0	118.5	FSP079-SPT-1	122.0	12.0	97.2%	2.0	Pass
PLC0815-1	79	8/15/97	5	7	17	114.0	12.9	101.0	FSP079-SPT-1	122.0	12.0	82.8%	0.9	[7]
PLC0815-2	79	8/15/97	5	7	17	124.5	15.6	107.7	FSP079-SPT-1	122.0	12.0	88.3%	3.6	[7]
PLC0815-3	79	8/15/97	6	6	17	133.1	15.4	115.3	FSP079-SPT-1	122.0	12.0	94.5%	3.4	Pass
PLC0815-4	79	8/15/97	8	11	15	126.2	12.4	112.3	FSP079-SPT-1	122.0	12.0	92.0%	0.4	Pass
PLC0818-1	79	8/18/97	8	11	17	133.4	15.8	115.2	FSP079-SPT-1	122.0	12.0	94.4%	3.8	Pass
PLC0818-2	79	8/18/97	9	11	14	139.0	17.8	118.0	FSP079-SPT-1	122.0	12.0	96.7%	5.8	Pass
PLC0821-1	79	8/21/97	8	9	15	139.0	18.7	117.1	FSP079-SPT-1	122.0	12.0	95.9%	6.7	Pass
PLC0821-1	80	8/21/97	11	8	15	136.4	18.4	115.2	FSP080-SPT-1	121.0	12.8	95.2%	5.6	Pass
PLC0821-2	80	8/21/97	11	11	16	131.0	18.3	110.7	FSP080-SPT-1	121.0	12.8	91.5%	5.5	Pass
PLC0822-1	80	8/22/97	7	11	18	133.6	15.4	115.8	FSP080-SPT-1	121.0	12.8	95.7%	2.6	Pass
PLC0822-2	80	8/22/97	4	9	19	131.8	18.2	111.5	FSP080-SPT-1	121.0	12.8	92.1%	5.4	Pass
PLC0825-1	80	8/25/97	7	9	18	131.0	16.8	112.2	FSP080-SPT-1	121.0	12.8	92.7%	4.0	Pass
PLC0825-2	81	8/25/97	8	7	17	134.8	15.9	116.3	FSP081-SPT-1	122.3	11.6	95.1%	4.3	Pass
PLC0825-3	81	8/25/97	9	12	17	138.1	18.5	116.5	FSP081-SPT-1	122.3	11.6	95.3%	6.9	Pass
PLC0826-1	81	8/26/97	8	11	19	136.2	16.7	116.7	FSP081-SPT-1	122.3	11.6	95.4%	5.1	Pass

Table 11: Construction Quality Control of Solidified/Stabilized Material by Sand Cone Density Test

Monolith Data									Feedstock Pile Data				Monolith Data	
Sandcone Test No.	Feedstock Pile Source Batch No.	Date	Row	Col	Lift No.	Total Density (lb/ft^3) [1]	Moisture Content (%)	Dry Density (lb/ft^3)	Modified Proctor Sample No.	Maximum Dry Density (lb/ft^3)	Optimum Moisture Content (%)	Percent Modified Proctor [2]	Moisture Content Variance (%) [3]	Note
PLC0826-2	81	8/26/97	10	10	19	140.9	15.5	122.0	FSP081-SPT-1	122.3	11.6	99.7%	3.9	Pass
PLC0828-1	82	8/28/97	9	6	19	131.5	16.4	113.0	FSP082-SPT-1	122.4	10.8	92.3%	5.6	Pass
PLC0828-2	82	8/28/97	7	5	19	130.9	17.2	111.7	FSP082-SPT-1	122.4	10.8	91.2%	6.4	Pass
PLC0829-1	82	8/29/97	11	6	17	134.4	14.9	117.0	FSP082-SPT-1	122.4	10.8	95.6%	4.1	Pass
PLC0829-2	82	8/29/97	22	6	1	141.9	16.1	122.2	FSP082-SPT-1	122.4	10.8	99.9%	5.3	Pass
PLC0902-1	82	9/2/97	22	13	2	134.9	20.2	112.2	FSP082-SPT-1	122.4	10.8	91.7%	9.4	Pass
PLC0902-2	82	9/2/97	22	12	3	134.7	18.4	113.8	FSP082-SPT-1	122.4	10.8	92.9%	7.6	Pass
PLC0902-3	82	9/2/97	22	11	4	138.4	16.9	118.4	FSP082-SPT-1	122.4	10.8	96.7%	6.1	Pass
PLC0903-1	82	9/3/97	13	7	16	136.5	15.3	118.4	FSP082-SPT-1	122.4	10.8	96.5%	4.5	Pass
PLC0903-2	83	9/3/97	12	9	18	135.0	16.9	115.5	FSP083-SPT-1	122.7	12.1	94.1%	4.8	Pass
PLC0904-1	83	9/4/97	22	9	5	141.5	17.3	120.6	FSP083-SPT-1	122.7	12.1	98.3%	5.2	Pass
PLC0904-2	84	9/4/97	22	6	6	133.0	18.1	112.6	FSP084-SPT-1	121.2	10.6	92.9%	7.5	Pass
PLC0905-1	84	9/5/97	21	11	9	135.6	16.7	116.2	FSP084-SPT-1	121.2	10.6	95.9%	6.1	Pass
PLC0905-2	84	9/5/97	22	10	12	135.7	16.1	116.9	FSP084-SPT-1	121.2	10.6	96.5%	5.5	Pass
PLC0919-1	85	9/19/97	23	11	1	136.0	16.6	116.6	FSP085-SPT-1	123.3	12.2	94.6%	4.4	Pass
PLC0919-2	85	9/19/97	24	7	1	130.3	15.9	112.4	FSP085-SPT-1	123.3	12.2	91.2%	3.7	Pass
PLC0922-1	85	9/22/97	24	13	2	135.2	11.7	121.0	FSP085-SPT-1	123.3	12.2	98.1%	0.5	Pass
PLC0922-2	85	9/22/97	23	10	2	126.3	13.7	111.1	FSP085-SPT-1	123.3	12.2	90.1%	1.5	Pass
PLC0924-1	86	9/24/97	23	9	3	131.7	13.5	116.0	FSP086-SPT-1	120.4	9.4	96.4%	4.1	Pass
PLC0924-2	86	9/24/97	24	12	4	134.7	14.8	117.3	FSP086-SPT-1	120.4	9.4	97.4%	5.4	Pass
PLC0925-1	86	9/25/97	24	10	5	133.5	17.9	113.2	FSP086-SPT-1	120.4	9.4	94.0%	8.5	Pass
PLC0925-2	86	9/25/97	23	11	6	132.9	13.9	116.7	FSP086-SPT-1	120.4	9.4	96.9%	4.5	Pass
PLC0929-1	86	9/29/97	15	11	12	133.5	13.4	117.7	FSP086-SPT-1	120.4	9.4	97.7%	4.0	Pass
PLC0929-2	86	9/29/97	13	8	13	136.1	16.5	116.8	FSP086-SPT-1	120.4	9.4	97.0%	7.1	Pass
PLC0930-1	87	9/30/97	13	10	15	137.0	15.8	118.3	FSP087-SPT-1	120.2	13.3	98.4%	2.5	Pass
PLC0930-2	87	9/30/97	15	11	14	138.4	17.9	117.4	FSP087-SPT-1	120.2	13.3	97.6%	4.6	Pass
PLC1001-1	85	10/1/97	11	11	16	138.9	15.2	120.6	FSP085-SPT-1	123.3	12.2	97.8%	3.0	Pass
PLC1001-2	85	10/1/97	12	9	16	136.0	16.7	116.5	FSP085-SPT-1	123.3	12.2	94.5%	4.5	Pass
PLC1014-1	85	10/14/97	12	11	17	136.8	16.6	117.3	FSP085-SPT-1	123.3	12.2	95.1%	4.4	Pass
PLC1016-1	85	10/16/97	11	7	17	136.8	14.9	119.1	FSP085-SPT-1	123.3	12.2	96.6%	2.7	Pass
PLC1016-2	87	10/16/97	17	7	16	132.6	16.7	113.6	FSP087-SPT-1	120.2	13.3	94.5%	3.4	Pass
PLC1017-1	87	10/17/97	15	9	17	135.7	15.7	117.3	FSP087-SPT-1	120.2	13.3	97.6%	2.4	Pass
PLC1017-2	87	10/17/97	15	11	17	136.7	16.2	117.6	FSP087-SPT-1	120.2	13.3	97.8%	2.9	Pass
PLC1017-3	87	10/17/97	17	8	16	123.2	13.8	108.3	FSP087-SPT-1	120.2	13.3	90.1%	0.5	Pass

Table 11: Construction Quality Control of Solidified/Stabilized Material by Sand Cone Density Test

Monolith Data									Feedstock Pile Data				Monolith Data	
Sandcone Test No.	Feedstock Pile Source Batch No.	Date	Row	Col	Lift No.	Total Density (lb/ft^3) [1]	Moisture Content (%)	Dry Density (lb/ft^3)	Modified Proctor Sample No.	Maximum Dry Density (lb/ft^3)	Optimum Moisture Content (%)	Percent Modified Proctor [2]	Moisture Content Variance (%) [3]	Note
PLC1022-1	87	10/22/97	23	11	7	136.9	15.9	118.1	FSP087-SPT-1	120.2	13.3	98.3%	2.6	Pass
PLC1022-2	87	10/22/97	20	11	13	132.2	14.0	116.0	FSP087-SPT-1	120.2	13.3	96.5%	0.7	Pass
PLC1029-1	87	10/29/97	24	11	8	136.4	18.5	115.1	FSP087-SPT-1	120.2	13.3	95.7%	5.2	Pass
PLC1029-2	87	10/29/97	24	10	9	132.2	17.5	112.5	FSP087-SPT-1	120.2	13.3	93.6%	4.2	Pass
PLC1030-1	87	10/30/97	24	9	10	134.7	17.2	114.9	FSP087-SPT-1	120.2	13.3	95.6%	3.9	Pass
PLC1030-2	88	10/30/97	23	8	11	135.3	19.6	113.1	FSP088-SPT-1	122.0	13.4	92.7%	6.2	Pass
PLC1031-1	88	10/31/97	22	8	13	133.6	15.1	116.1	FSP088-SPT-1	122.0	13.4	95.2%	1.7	Pass
PLC1031-2	88	10/31/97	22	9	13	132.1	17.3	112.6	FSP088-SPT-1	122.0	13.4	92.3%	3.9	Pass
PLC1105-1	88	11/5/97	23	9	14	132.5	18.2	112.1	FSP088-SPT-1	122.0	13.4	91.9%	4.8	Pass
PLC1106-1	88	11/6/97	6	10	20	133.7	16.3	115.0	FSP088-SPT-1	122.0	13.4	94.3%	2.9	Pass
PLC1113-1	88	11/13/97	7	6	20	133.5	14.8	116.3	FSP088-SPT-1	122.0	13.4	95.3%	1.4	Pass
PLC1113-2	88	11/13/97	7	5	20	133.2	12.4	118.5	FSP088-SPT-1	122.0	13.4	97.1%	1.0	Pass

Notes:

1 lb/ft^3 = pounds per cubic feet

2 Acceptance criteria 90%

3 Acceptance criteria +4 to +6% over optimum moisture content

4 Retested

5 Evaluated and determined to be acceptable

6 Recompacted and retested

7 Removed and replaced with fresh soil cement

Table 12: Permeability Test Results for Clay

Clay Sample	Maximum Dry Density (lb/ft^3)	Optimum Moisture Content (%)	Test No.	Dry Density (lb/ft^3)	Percent Compaction (%)	Molding Moisture Content (%)	Moisture Content Variance (%)	Permeability (cm/sec)
A	118.0	13.6	AP3	115.9	98.2	16.7	3.1	3.30E-08
A	118.0	13.6	A-1	113.5	96.2	17.8	4.2	1.20E-08
C	116.6	14.5	C-1	111.2	95.4	7.9	-6.6	7.50E-07
C	116.5	14.5	C-2	115.7	99.2	11.8	-2.7	7.30E-08
C	116.6	14.5	C-3	108.9	93.4	20.1	5.6	1.10E-08
C	116.6	14.5	C-4	105.6	90.6	20.6	6.1	1.70E-08
C	116.6	14.5	C-5	104.9	90.0	14.1	-0.4	1.20E-05
D	115.6	13.8	D-1	104.6	90.5	18.9	5.1	2.50E-06
D	115.6	13.8	D-2	113.4	98.1	15.0	1.2	1.60E-07
D	115.6	13.8	D-3	114.9	99.4	14.6	0.8	4.70E-08
E	114.3	15.5	E-1	108.5	94.9	16.9	1.4	6.00E-07
E	114.3	15.5	E-2	110.8	96.9	16.2	0.7	1.50E-07
E	114.3	15.5	E-2A	112.9	98.8	15.6	0.1	9.00E-08
F	115.2	15.0	F-1	107.8	93.6	18.7	3.7	8.10E-08
G	113.0	16.0	G-1	109.5	96.9	15.1	-0.9	9.90E-07
G	113.0	16.0	G-2	108.3	95.8	15.1	-0.9	1.00E-06
G	113.0	16.0	G-3	110.0	97.4	17.6	1.6	2.80E-08
H	114.5	15.5	H-1	106.7	93.2	16.9	1.4	2.20E-07
H	114.5	15.5	H-2	111.5	97.4	17.5	2.0	2.00E-08

Notes:
lb/ft3 = pounds per cubic feet
cm/sec = centimeters per second

Table 13: Summary of Rock Quality Scores for Rip Rap and Gravel Material

LABORATORY TEST	WEIGHTING FACTOR IGNEOUS ROCK	SAMPLE WEIGHTING FACTOR	SAMPLE SCORE	BEST POSSIBLE IGNEOUS
ALBERT FREI & SONS ROCK QUALITY SCORE FOR RIP RAP				
SAMPLE 1 (0% PLACEMENT LEVEL)				
SPECIFIC GRAVITY	9	10	90	90
ABSORPTION %	2	8.5	17	20
SODIUM SULFATE %	11	10	110	110
L/A ABRASION	1	0	0	10
	TOTAL		217	230
	SCORE	**217 / 230 =**	**94.3%**	
SAMPLE 2 (25% PLACEMENT LEVEL)				
SPECIFIC GRAVITY	9	10	90	90
ABSORPTION %	2	8	16	20
SODIUM SULFATE %	11	10	110	110
L/A ABRASION	1	0	0	10
	TOTAL		216	230
	SCORE	**216 / 230 =**	**93.9%**	
SAMPLE 3 (50% PLACEMENT LEVEL)				
SPECIFIC GRAVITY	9	10	90	90
ABSORPTION %	2	9	18	20
SODIUM SULFATE %	11	10	110	110
L/A ABRASION	1	1	1	10
	TOTAL		219	230
	SCORE	**219 / 230 =**	**95.2%**	
SAMPLE 4 (75% PLACEMENT LEVEL)				
SPECIFIC GRAVITY	9	10	90	90
ABSORPTION %	2	9.5	19	20
SODIUM SULFATE %	11	10	110	110
L/A ABRASION	1	0.6	0.6	10
	TOTAL		219.6	230
	SCORE	**219.6 / 230 =**	**95.5%**	
WESTERN MOBILE ROCK QUALITY SCORE FOR AGGREGATE				
SPECIFIC GRAVITY	9	9.2	82.8	90
ABSORPTION %	2	5.6	11.2	20
SODIUM SULFATE %	11	9	99	110
L/A ABRASION	1	1.1	1.1	10
	TOTAL		194.1	230
	SCORE	**194.1 / 230 =**	**84.4%**	

Table 14: Summary of Clay Cover Field Compaction Test Results

Sandcone Test No.	Date	Row No.	Col No.	Wet Density (PCF)	Moisture Content (%)	Dry Density (PCF)	Percent Compaction (%)	Notes
IC1121TOP-1	11/21/97	4	5	128.9	21.3	106.3	92.5	PASS
IC1124TOP-1	11/24/97	8	5	125.9	15.4	109.1	95.0	PASS
IC1124TOP-2	11/24/97	6	7	127.6	17.0	109.1	95.0	PASS
IC1124TOP1A	11/24/97	8	5	134.0	16.4	115.1	100.2	PASS
IC1124TOP2A	11/24/97	6	7	134.4	18.8	113.1	98.4	PASS
IC1125TOP-1	11/25/97	8	5	128.7	15.3	111.6	97.1	PASS
IC1125TOP-2	11/25/97	10	7	131.3	15.4	113.8	99.0	PASS
IC1126TOP-1	11/26/97	10	6	129.5	19.0	108.8	94.7	PASS
IC1126TOP-2	11/26/97	7	9	129.1	19.0	108.5	94.4	PASS
IC1202TOP-1	12/2/97	15	9	127.4	17.6	108.3	94.3	PASS
IC1202TOP1A	12/8/97	14	9	124.8	18.9	105.0	91.4	PASS
IC1208TOP-1	12/8/97	4	10	126.0	20.7	104.4	90.9	PASS
IC1208TOP-2	12/8/97	8	10	126.6	21.6	104.1	91.0	PASS
IC1208TOP-3	12/8/97	12	10	123.6	22.4	101.0	87.9	1
IC1208TOP-4	12/8/97	12	7	103.5	17.4	88.2	76.8	1
IC1209TOP-1	12/9/97	17	10	125.0	19.4	104.7	91.1	PASS
IC1209TOP-2	12/9/97	17	7	123.6	18.3	104.5	90.9	PASS
IC1215TOP-1	12/15/97	20	7	121.2	20.0	101.0	87.9	1
IC1215TOP-2	12/15/97	20	10	121.2	20.0	101.0	87.9	1
IC0227TOP-3	2/27/98	20	7	133.1	18.3	112.5	97.9	PASS
IC0312TOP-1	3/12/98	20	10	133.0	18.0	112.7	98.1	PASS,RT1215TOP-2
IC0312TOP-2	3/12/98	20	7	130.8	18.7	110.2	95.9	PASS,RT1215TOP-1
IC0312TOP-3	3/12/98	12	10	128.1	17.7	108.8	94.7	PASS,RT1208TOP-3
IC0312TOP-4	3/12/98	12	7	127.2	18.2	107.6	93.6	PASS,RT1208TOP-4

NOTES:
1) Moisture conditioned, recompacted and retested
2) RT : Retest
3) Acceptance criterion for clay placed on top of monolith : 90 % of averaged maximum dry density (114.9 pcf)
4) Clay cover was placed in one single lift on top of the monolith.
5) Sand cone tests were performed in accordance with ASTM D-1556.

pcf = pounds per cubic foot

Table 14a: Summary of Field Compaction Test Results for RSCL Placement (Sideslopes)

Sandcone Test No.	Date	Row No.	Col No.	Lift No.	Wet Density (PCF)	Moisture Content (%)	Dry Density (PCF)	Minimum Dry Density (PCF)	Notes
IC0224SS-1	2/24/98	3	7	1	125.8	19.1	105.6	107.2	1
IC0224SS-2	2/24/98	3	7	1	124.4	18.8	104.7	107.6	1,RT0224SS-1
IC0225SS-1	2/25/98	3	7	1	125.8	20.4	104.5	105.7	1,RT0224SS-2
IC0225SS-2	2/25/98	2	9	1	129.5	18.6	109.2	107.8	PASS
IC0225ES-3	2/25/98	4	11	1	121.7	20.5	101.0	105.6	1
IC0226ES-1	2/26/98	7	12	1	139.0	19.2	116.6	107.1	PASS
IC0226ES-2	2/26/98	12	12	1	129.3	19.6	108.1	106.7	PASS
IC0227ES-1	2/27/98	19	11	1	125.6	18.7	105.8	107.7	1
IC0228SS-1	2/28/98	3	7	1	131.9	17.1	112.6	109.5	PASS,RT0225SS-1
IC0228ES-2	2/28/98	4	11	1	131.0	19.0	110.1	107.4	PASS,RT0225ES-3
IC0228ES-3	2/28/98	19	11	1	128.2	19.1	107.6	107.2	PASS,RT0227ES-1
IC0302WS-1	3/2/98	15	4	1	130.5	20.7	108.1	105.4	PASS
IC0302WS-2	3/2/98	9	4	1	126.5	18.6	106.7	107.8	1
IC0303WS-1	3/3/98	9	4	1	129.0	19.8	107.7	106.4	PASS,RT0302WS-2
IC0303SS-2	3/3/98	2	9	2	126.3	19.3	105.9	107.0	1
IC0303ES-3	3/3/98	5	12	2	126.5	20.7	104.8	105.4	1
IC0303SS-4	3/3/98	2	9	2	124.6	20.9	103.1	105.2	1,RT0303SS-2
IC0304SS-1	3/4/98	2	9	2	125.1	21.0	103.4	105.1	1,RT0303SS-4
IC0304ES-2	3/4/98	21	12	1	132.6	19.1	111.3	107.2	PASS
IC0304WS-3	3/4/98	21	4	2	122.3	19.9	102.0	106.3	1
IC0305WS-1	3/5/98	21	4	2	127.5	19.8	106.4	106.4	PASS,RT0304WS-3
IC0305SS-2	3/5/98	2	9	2	125.4	21.4	103.3	104.6	1,RT0304SS-1
IC0305ES-3	3/5/98	5	12	2	127.2	20.8	105.3	105.3	PASS,RT0303ES-3
IC0305SS-4	3/5/98	2	9	2	124.3	20.8	102.9	105.3	1,RT0305SS-2
IC0305WS-5	3/5/98	12	3	2	125.0	18.3	105.7	108.2	1
IC0305WS-6	3/5/98	6	3	2	128.5	19.8	107.3	106.4	PASS
IC0306WS-1	3/6/98	12	3	2	128.3	17.7	109.0	108.8	PASS,RT0305WS-5
IC0306SS-2	3/6/98	2	9	2	128.4	17.6	109.2	109.0	PASS,RT0305SS-4
IC0306NS-3	3/6/98	24	10	2	123.7	17.5	105.3	109.1	1
IC0306ES-4	3/6/98	6	12	3	130.0	15.7	112.4	111.1	PASS
IC0309NS-1	3/9/98	24	10	2	128.0	18.5	108.0	107.9	PASS,RT0306NS-3

Table 14a: Summary of Field Compaction Test Results for RSCL Placement (Sideslopes) cont.

SANDCONE TEST NO.	DATE	ROW NO.	COL NO.	LIFT NO.	WET DENSITY (PCF)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	MINIMUM DRY DENSITY (PCF)	NOTES
IC0310ES-1	3/10/98	15	2	3	127.9	18.4	108.0	108.0	PASS
IC0310WS-2	3/10/98	17	5	3	123.7	18.7	104.2	107.7	1
IC0310NS-3	3/10/98	24	9	3	128.1	21.1	105.8	104.9	PASS
IC0312SS-1	3/12/98	2	8	3	129.1	18.2	109.2	108.3	PASS
IC0312WS-2	3/12/98	17	5	3	123.7	17.0	105.7	109.7	1,RT0310WS-2
IC0313WS-1	3/13/98	17	5	3	129.4	17.5	110.1	109.1	PASS,RT0312WS-2
IC0313ES-2	3/13/98	9	13	4	127.7	17.4	108.8	109.2	1
IC0313WS-3	3/13/98	16	3	4	122.4	17.8	103.9	108.7	1
IC0314ES-1	3/14/98	9	13	4	122.2	16.5	104.9	110.2	1,RT0313ES-2
IC0314WS-2	3/14/98	16	3	4	128.3	18.0	108.7	108.5	PASS,RT0313WS-3
IC0314WS-3	3/14/98	6	2	4	129.4	17.2	110.4	109.4	PASS
IC0314ES-4	3/14/98	9	13	4	130.7	16.7	112.0	110.0	PASS,RT0314ES-1
IC0316ES-1	3/16/98	21	12	4	126.3	19.4	105.8	106.9	1
IC0316ES-2	3/16/98	21	12	4	127.5	19.7	106.5	106.5	PASS,RT0316ES-1
IC0331SS-1	3/31/98	1	5	1	129.3	14.7	112.7	112.3	PASS,
IC0331SS-2	3/31/98	1	5	2	131.5	13.1	116.3	114.1	1
IC0331SS-3	3/31/98	1	5	2	134.5	13.4	118.6	113.8	1,RT0331SS-2
IC0401SS-1	4/1/98	1	5	2	136.7	13.1	120.9	114.1	1,RT0331SS-3
IC0401SS-2	4/1/98	1	5	2	127.4	18.4	107.6	108.0	1,RT0401SS-1
IC0401SS-3	4/1/98	1	5	2	125.3	22.5	102.3	103.3	1,RT0401SS-2
IC0401SS-4	4/1/98	1	5	2	127.0	16.5	109.0	110.2	1,RT0401SS-3
IC0401SS-5	4/1/98	1	5	2	131.7	15.7	113.8	111.1	PASS
IC0402SS-1	4/2/98	1	5	3	129.8	14.0	113.9	113.1	PASS
IC0402SS-2	4/2/98	1	5	2	132.4	15.0	115.1	112.0	PASS,RT0401SS-4

NOTES:
1) Moisture conditioned, recompacted and retested
2) RT : Retest
3) Acceptance criterion for clay placed on side slopes : minimum dry density which varies with moisture content
4) Sand cone tests were performed in accordance with ASTM D-1556 procedures.

Table 15: Summary of Cover Material Placed

Cover Material	Tons Placed	Source
Clay	21,011	Bluestone Aggregate
Sand	11,416	Bluestone Aggregate
Gravel	10,984	Western Mobil
Rip Rap	17,956	Albert Frei & Sons

Table 16: Results of Gamma Survey of Monolith Cover System

Survey Location	Gamma [surface] (uR/h)	Gamma [1 meter above surface] (uR/hr)
9600	12.0	12.0
9601	11.0	11.0
9602	13.0	13.0
9603	10.5	10.5
9604	12.0	12.0
9605	12.0	12.0
9606	11.5	12.0
9607	11.0	11.0
9608	13.0	13.0
9609	10.5	10.5
9610	10.0	10.0
9611	10.5	11.0
9612	11.5	11.5
9613	11.0	11.0
9614	12.0	12.0
9615	12.0	12.0
9616	12.0	12.5
9617	12.0	12.0
9618	11.0	11.0
9619	14.0	14.0
9620	12.0	12.0
9621	12.0	12.0
9622	13.0	13.0
9623	11.0	11.0
9624	15.0	16.0
9625	10.0	10.0
9626	11.0	10.5
9627	10.0	10.0
9628	10.5	10.5
9629	12.0	12.0

Survey Location	Gamma [surface] (uR/hr)	Gamma [1 meter above surface] (uR/hr)
9630	12.0	12.0
9631	12.0	12.0
9632	10.0	10.0
9633	13.0	13.0
9634	11.0	11.0
9635	10.0	10.0
9636	11.0	11.0
9637	12.0	12.0
9638	11.0	11.0
9639	11.0	11.0
9640	12.0	12.0
9641	13.0	13.0
9642	12.0	12.0
9643	11.0	11.0
9644	13.0	13.0
9645	13.0	13.0
9646	12.0	12.0
9647	12.0	12.5
9648	13.0	13.0
9649	16.0	16.0
9650	11.0	11.0
9651	11.0	11.0
9652	11.0	11.0
9653	10.5	10.5
9654	11.0	11.0
9655	11.0	11.0
9656	11.0	11.0
9657	12.0	12.0
9658	10.0	10.0
9659	11.0	10.5

Survey Location	Gamma [surface] (uR/hr)	Gamma [1 meter above surface] (uR/hr)
9660	11.0	11.0
9661	11.5	11.0
9662	13.0	13.0
9663	11.0	11.0
9664	11.0	11.5
9665	12.0	12.0
9666	12.0	12.0
9667	13.0	13.0
9668	12.0	12.0
9669	13.0	13.0
9670	11.5	11.5
9671	12.0	12.0
9672	13.0	13.0
9673	14.0	14.0
9674	17.0	17.0
9675	11.0	11.0
9676	11.5	11.0
9677	12.0	12.0
9678	11.5	11.0
9679	12.0	12.0
9680	11.0	11.0
9681	14.0	14.0
9682	12.0	12.0
9683	11.0	11.0
9684	10.0	10.0
9685	11.0	11.0
9686	11.0	11.0
9687	12.0	12.0
9688	11.5	11.5
9689	12.0	12.0

Table 16: Results of Gamma Survey of Monolith Cover System

Survey Location	Gamma [surface] (uR/h)	Gamma [1 meter above surface] (uR/hr)
9690	12.0	12.0
9691	11.5	11.5
9692	12.0	12.0
9693	12.0	12.0
9694	14.0	14.0
9695	12.0	12.0
9696	12.0	12.0
9697	12.0	12.0
9698	14.0	14.0
9699	17.0	17.0
9700	12.0	12.0
9701	12.0	11.5
9702	11.5	11.5
9703	11.0	11.0
9704	11.0	11.0
9705	11.0	11.0
9706	13.0	13.0
9707	12.0	12.0
9708	11.0	11.5
9709	12.0	12.0
9710	11.0	11.0
9711	11.0	11.0
9712	12.0	12.0
9713	11.0	11.0
9714	12.0	12.0
9715	11.0	11.0
9716	11.0	11.0
9717	12.0	12.0
9718	14.0	14.0
9719	20.0	20.0

Survey Location	Gamma [surface] (uR/hr)	Gamma [1 meter above surface] (uR/hr)
9720	12.0	12.0
9721	12.0	12.0
9722	12.0	12.0
9723	12.0	12.0
9724	17.0	17.0
9725	11.0	11.0
9726	11.5	11.0
9727	12.0	12.0
9728	11.0	11.0
9729	11.0	11.0
9730	11.0	11.0
9731	12.0	11.5
9732	10.0	10.0
9733	10.0	10.0
9734	11.0	11.0
9735	12.0	12.0
9736	11.0	11.0
9737	12.0	12.0
9738	11.0	11.0
9739	11.0	11.5
9740	11.0	11.0
9741	12.5	12.5
9742	11.0	11.0
9743	13.0	13.0
9744	12.0	12.0
9745	12.0	12.0
9746	12.5	12.5
9747	13.0	13.0
9748	13.0	13.0
9749	17.0	17.0

Survey Location	Gamma [surface] (uR/hr)	Gamma [1 meter above surface] (uR/hr)
9750	11.5	11.0
9751	10.5	11.0
9752	11.0	11.0
9753	11.0	11.0
9754	12.0	12.0
9755	11.0	11.0
9756	11.0	11.0
9757	13.0	13.0
9758	10.0	10.0
9759	11.0	11.0
9760	11.0	11.0
9761	11.0	11.0
9762	11.0	11.0
9763	12.0	12.0
9764	11.0	11.0
9765	11.5	11.5
9766	12.0	12.0
9767	11.0	11.0
9768	12.0	12.0
9769	12.0	12.0
9770	12.0	12.0
9771	12.0	12.0
9774	18.5	18.0
9776	11.0	11.0
9777	10.5	10.5
9778	10.0	10.0
9779	11.0	11.0
9780	11.5	12.0
9781	12.0	12.0
9782	12.0	12.0

Table 16: Results of Gamma Survey of Monolith Cover System

Survey Location	Gamma [surface] (uR/h)	Gamma [1 meter above surface] (uR/hr)
9783	12.0	12.0
9784	20.0	20.0
9785	12.0	12.0
9786	12.0	11.5
9787	11.0	11.0
9788	11.0	11.0
9789	11.5	11.5
9790	11.0	11.0
9791	11.5	11.5
9792	14.0	14.0
9795	11.0	11.0
9796	12.0	12.0
9797	12.0	12.0
9798	12.0	12.0
9799	12.0	12.0
9801	10.0	10.0
9802	10.5	10.0
9803	11.0	11.0
9804	10.0	10.0
9805	12.0	12.0
9806	12.0	12.0
9807	11.0	11.0
9808	12.0	12.0
9809	13.0	13.0
9810	12.0	12.0
9811	12.0	12.0
9812	11.0	11.0
9815	12.0	12.0
9816	12.0	12.0
9817	13.0	13.0
9818	11.0	11.5
9819	11.0	11.0
9821	11.0	11.0
9822	10.0	10.0
9823	11.0	11.0
9824	11.0	11.0
9825	11.0	11.0
9826	12.0	12.0
9827	11.0	11.0
9829	12.0	12.0
9830	12.0	12.0
9831	11.0	11.0
9832	11.0	11.0
9833	11.0	11.0
9834	12.0	12.0
9835	12.0	12.0
9836	11.0	11.0
9838	14.0	14.0
9839	12.0	12.0
9840	13.5	13.0
9841	12.0	12.0
9842	12.0	11.5
9844	11.0	11.0
9845	11.0	11.0
9846	11.0	11.0
9850	17.0	17.0
9851	17.0	17.0
9852	17.0	17.0
9853	16.5	16.5
9854	18.0	18.0
9855	18.0	18.5
9856	17.0	17.0

Notes:
Survey conducted 6/23/98 and 6/24/98
Background = 11 uR
Survey conducted with Ludlum Measurements Inc. Micro R Meter Model No. 19, Serial No. 98063

Table 17: Monolith Cover Radon Flux Measurements

Grid Location	Sample I. D.	Radon Flux (pCi/m²s)	Error ± (pCi/m²s)	LLD (pCi/m²s)
9505	D9505	0.25	0.04	0.01
9511	D9511	0.39	0.05	0.01
9504	D9504	0.02	0.03	0.01
9503	D9503	0.04	0.03	0.01
9502	D9502	0.00	0.03	0.01
9501	D9501	0.04	0.03	0.01
9500	D9500	0.02	0.03	0.01
9506	D9506	0.04	0.03	0.01
9512	D9512	0.02	0.03	0.01
9513	D9513	0.04	0.03	0.01
9514	D9514	0.02	0.03	0.01
9510	D9510	0.00	0.03	0.01
9509	D9509	0.05	0.03	0.01
9508	D9508	0.00	0.03	0.01
9507	D9507	0.03	0.03	0.01
	Average Radon Flux:	0.06	pCi/m²s	

Blank Canister Analysis				
Grid Location	Sample I. D.	Radon Flux (pCi/m²s)	Error ± (pCi/m²s)	LLD (pCi/m²s)
Blank	Blank 1	0.03	0.03	0.03

Recount Canister Analysis					
Grid Location	Sample I. D.	Radon Flux (pCi/m²s)	Error ± (pCi/m²s)	LLD (pCi/m²s)	Precision, RPD
9505	D9505	0.25	0.04	0.01	
Recount	D9505	0.24	0.06	0.06	6.0%
9514	D9514	0.02	0.03	0.01	
Recount	D9514	0.02	0.05	0.06	0.0%
Average Precision (RPD) of Canister Recount Analysis:					3.0%

Notes:
LLD = lower limit of detectable activity
pCi/m²s = picocuries per square meter per second
RPD = relative percent difference

Table 18 - Site Perimeter Radon Gas Sampling Results

Device I.D.	Radon (pCi/l)	Error (±pCi/l)	LLD (pCi/l)
B058	0.33	0.2	0.3
D024	0.45	0.2	0.3
A044	0.30	0.2	0.3
A008	0.13	0.2	0.3
B074	0.14	0.2	0.4
D072	0.22	0.2	0.3
F148	0.43	0.2	0.3
F208	0.25	0.2	0.3
A050	0.19	0.2	0.3
E076	0.49	0.2	0.3
B037	0.54	0.2	0.3
F010	0.00	0.2	0.3
E165	0.36	0.2	0.3
E138	0.41	0.2	0.3
A089	0.30	0.2	0.3
F033	0.46	0.2	0.3
F050	0.45	0.2	0.3
F019	0.39	0.2	0.3
B078	0.13	0.2	0.3
B050	0.33	0.2	0.4
F044	-0.07	0.2	0.4
F191	0.19	0.2	0.4
F055	-0.08	0.2	0.4
A081	0.26	0.2	0.3

Canister Recount Analysis				
Device I.D.	Radon (pCi/l)	Error (±pCi/l)	LLD (pCi/l)	Precision, RPD
B058	0.33	0.2	0.3	
B058	0.24	0.4	0.6	30.1%
B037	0.54	0.2	0.3	
B037	0.60	0.3	0.6	11.3%

Notes:
LLD = lower limit of detectable activity
pCi/l = picocuries per liter of air
RPD = relative percent difference

Table 19: Compaction Tests for General Fill Placed on North End of Site

Sandcone Test No.	Date	Row No.	Col No.	Lift No.	Moisture Content (%)	Dry Density (PCF)	Fill Soil Designation	Maximum Dry Density (PCF)	Percent Compaction (%)	Notes
GF0228NS-1	2/28/98	25	7	1	13.8	117.9	SITE C	121.0	97.4	PASS
GF0302NS-1	3/2/98	25	11	1	8.8	121.0	SITE C	121.0	100.0	PASS
GF0303NS-1	3/3/98	25	9	1	11.5	119.5	SITE C	121.0	98.8	PASS
GF0503NS-1	5/3/98	26	9	1	15.6	109.4	SITE E	120.1	91.1	PASS
GF0503NS-2	5/3/98	26	8	2	16.1	110.1	SITE E	120.1	91.7	PASS
GF0503NS-3	5/3/98	26	8	3	15.8	112.3	SITE E	120.1	93.5	PASS
GF0507NS-1	5/7/98	25	10	1	14.6	116.3	SITE E	120.1	96.8	PASS
GF0507NS-2	5/7/98	25	10	2	11.1	121.5	SITE A	131.0	92.7	PASS
GF0507NS-3	5/7/98	25	11	3	18.9	107.6	SITE D	117.0	92.0	PASS
GF0507NS-4	5/7/98	25	10	4	16.6	112.5	SITE E	120.1	93.7	PASS
GF0508NS-1	5/8/98	26	10	4	17.2	107.4	SITE D	117.0	91.8	PASS
GF0508NS-2	5/8/98	26	8	4	14.3	119.1	SITE A	131.0	90.9	PASS

NOTES:

1) Acceptance criterion for general fill : 90% of maximum dry density
2) SITE = On-site execavated BAL material used for general fill purposes.
3) Sand cone tests were performed in accordance with ASTM D-1556 procedures.

RADIOLOGICAL INSTRUMENTATION

Radiological Instrumentation

Detailed descriptions of the radiological instrumentation used at the Site are set forth below.

Geiger Counter

Ludlum Instrument Company Model 44-9 detectors connected to Ludlum Model 3 Ratemeters were used during site activities. Instruments were calibrated by an off-site vendor of calibration services, at 6-month intervals. Instruments were checked for function and detection efficiency each day. Geiger counters were used for health physics applications and scanning incoming and outgoing equipment and environmental surfaces in support areas for surface contamination by radioactive materials.

Alpha Scintillation Instruments

Ludlum Model 43-1 Alpha Scintillation Detectors connected to Ludlum Model 2221 Single Channel Analyzers were used during Site activities. The single channel analyzers could be operated in a ratemeter or counter mode. Instruments were calibrated by an off-site vendor of calibration services at 6-month intervals. Instruments were checked for function and counting efficiency each day. Alpha scintillation instruments were used for health physics applications and scanning incoming and outgoing equipment and environmental surfaces in support areas for contamination by radioactive materials.

Alpha/Beta Counter

A Ludlum Model 2200 Dual Channel Analyzer with Ludlum Model 43-10-1 Alpha and Beta Scintillation Detector was used during Site activities. The instrument was calibrated by an off-site vendor of calibration services at 6-month intervals. The instrument was checked for function and counting efficiency each day. The alpha/beta counter was used for measuring the amount of radioactivity present on air filters from the perimeter air monitoring system, on air filters from personal air monitoring pumps, on wipes obtained from incoming and outgoing equipment, and from environmental surfaces in the support areas.

Dose Rate Meters

Ludlum Model 19 MicroR Meters were used during Site activities. Instruments were calibrated by an off-site vendor of calibration services at 6-month intervals. The instruments were checked for functional response each day. Dose rate meters were used to measure potential personal exposure rates in work areas, decontamination facilities, and support areas.

Gamma Scintillation Instruments

Ludlum Model 44-10 Gamma Scintillation Detectors connected to Ludlum Model 2221 Single Channel Analyzers were used during Site activities. Single channel analyzers could be operated in a ratemeter or counter mode. The instruments were calibrated by an off-site vendor of calibration services at 6-month intervals and were checked for functional response each day. Gamma scintillation detectors were the principal instrument used for excavation control for the detection of radioactivity in soils.

OCS Gamma Spectrometer

A Canberra Multichannel Analyzer with a pair of EG&G Gamma Scintillation Detectors (OCS gamma spectrometer) was used during Site activities. The instrument was obtained through EPA for use on the Bannock Street Site. The OCS gamma spectrometer was serviced by Canberra as needed. Calibration was performed on-site on a weekly basis using radium standards supplied by EPA. Calibration was repeated each day the OCS gamma spectrometer was in use. The OCS gamma spectrometer was used for the semi-quantitative determination of radium in soil by surrogate measurement of the concentration of Bismuth-214.

Maintenance and Calibration

Routine instrument maintenance including replacement of batteries, replacement or repair of connecting cords, replacement of mylar windows (for alpha scintillation detectors) and replacement of counting cells for Geiger counters was performed on-site. Minor adjustments to the OCS gamma spectrometer to account for electronic drift in the detectors was also performed. Other maintenance operations were performed off-site by GTS.

All radiation detection instruments except the OCS gamma spectrometer used at the Bannock Street Site were calibrated by GTS on a 6-month scheduled basis. Additionally, instruments requiring off-site maintenance or repair were recalibrated prior to their return to use. The OCS gamma spectrometer was calibrated on-site every week and after any maintenance activities performed by Canberra.

Instrument Qualification

Inspection and qualification operations were performed on radiation monitoring equipment to determine if the instrument was received in good working order. The inspections included testing for mechanical integrity and operability. Certain instruments, including Geiger counters, alpha scintillation instruments, and the alpha/beta counter were tested for instrument qualification. These tests included:

- Determination of efficiency
- Determination of local instrument background
- Determination of instrument response factor

Local instrument background was determined in the instrument storage and maintenance shop in the Health and Safety trailer located near the northeast corner of the support zone. For ratemeter instruments, such as the Geiger counters and dose rate meters, background was determined as the midpoint of the normal range of fluctuation of the instrument reading with no sources exposed to the instrument. Background was determined for instruments equipped with counters, such as the gamma scintillation instruments, alpha scintillation instruments, and the alpha/beta counter by obtaining a discrete count over a period of at least ten minutes. The gross count was then converted to a background count rate per minute. Each background count rate was recorded on appropriate forms.

The alpha scintillation instruments and alpha/beta counter were qualified by efficiency of response to a source of known activity. A minimum of ten timed counts of 1-minute duration was obtained using an appropriate source. The source for determining alpha particle detection efficiency was thorium-230. The source for determining beta particle detection efficiency was technetium-99. The ten timed counts were used to calculate an average detection efficiency for each instrument. Each average efficiency was recorded on appropriate forms.

Instrument response factors of 0.4 to 1.6 for ten timed counts were used for instruments operating in scalar mode. The calculations and value of the response factor for each scalar instrument were recorded on appropriate forms.

Instrument qualification tests were performed on each instrument upon receipt and at the beginning of each week. The weekly qualification test results provided a target for daily evaluation of instrument performance evaluation.

Each instrument was checked for function and response prior to each day's use. The function checks included the following:

- Mechanical integrity of the instrument;

- Proper function at power on;
- Battery level;
- Qualitative response to check source;
- Instrument background; and
- Efficiency.

Daily instrument performance results were compared to the weekly qualification tests to determine if an instrument was operating within the normal range. The normal range for an instrument was $\pm$ 2 calculated standard deviations of the mean for instrument efficiency and $\pm$ 2 theoretical standard deviations of the background count rate. If an instrument did not perform within these limits, the qualification test was repeated and new performance characteristics for the instrument were determined.

Table 9-2
Action Levels and basis for determining the materials to be excavated

Contaminant	Action Level	Comments
Radium-226	5 pCi/g above background	Surface soils, 40 CFR 192 Subpart B, averaged over 100 m^2.
	15 pCi/g above background	Subsurface soils, 40 CFR 192 Subpart B, averaged over 100 m^2.
Thorium–230	42 pCi/g	Subsurface soils based on decay to radium-226 in 1000 years to achieve the subsurface standard of 15 pCi/g if the concentration of radium-226 is 0 pCi/g. If the concentration of radium-226 is greater than 0 pCi/g the thorium-230 action level will be lower. Generic protocol for excavation of thorium-230, DOE, January 25, 1989.
Uranium–Natural	75 pCi/g	U.S.D.O.E. Order 5480.1
Gamma Radiation	20 micro-Roentgens per hour above background	Based on the gamma radiation standard for inside buildings of 40 CFR 192, Subpart B; relevant to identifying areas of contamination.
ALARA	As Low As Reasonably Achievable	Excavate radioactive materials beyond the requirements of the numeric standards where consistent with remedial objective to maintain release of radioactivity to the general environment as low as is reasonably achievable
Arsenic Selenium Lead	160 mg/kg 490 mg/kg 540 mg/kg	These action levels are health-based values for a trespasser scenario, and thus are appropriate for surface areas where future use will be restricted.

Reference: Record of Decision, January 28, 1992.

PUGMILL CALIBRATION

Pugmill Instrumentation

The pugmill utilized by AWS Remediation for processing the AAL soils had a built-in computer control and digital displays. The computer control was capable of controlling the rate on input of soil, cement, flyash and water by weight. Prior to delivery of the pugmill to the Site, the S/S processing unit was calibrated by the manufacturer by completion of a live load test involving a soil dry run of 60 tons. The built-in controls were then adjusted to properly record the quantity of soils used for calibration. The pugmill was assembled on-site by the manufacturer, and a test load of approximately 50 tons of feedstock was processed and discarded for eventual reprocessing.

On a daily basis, the electronic controls of the pugmill were checked to re-set the controls system by completing a zero calibration. On a periodic basis, weights were placed on a weigh-bar for the soil, cement and flyash feedbelts to record the weight measured by the belt and thus ensure on-going accuracy of the processing unit feed system. The feedbelt lengths and running speeds were also measured and checked to verify the accuracy of the conveyor belt systems feeding soil, cement and flyash to the pugmill mixing chamber.

The pugmill utilized by FDGTI for processing AAL soils had a built-in computer control and digital displays. The computer control was capable of controlling the rate of input for soil, cement, fly ash and water by weight. Prior to production, the S/S processing unit was calibrated by cycling 15.1 tons (certified weight) of gravel through the system. The built-in belt scale registered 14.7 tons. The deviation of 2.65% between 15.1 and 14.7 tons was considered acceptable, considering losses (including moisture losses) during handling and hauling of the gravel from the quarry site and handling on-site. A trial mix run of the pugmill was conducted on May 15, 1997, processing 60 tons of the feedstock material. The trial run produced a generally uniform mixture of soil cement which complied with the construction specifications.

PERIMETER AIR MONITORING

Perimeter Air Monitoring

Each monitoring station consisted of a raised platform for each sampler. TSP and PM_{10} samplers manufactured by Graseby GMW were equipped with enclosures. Enclosures were fabricated for the RAS samplers. Air monitoring stations were located as shown in Figure X.

Sampling Station 1 was originally located along the fence separating the Bannock Street Site from the Flanagan property on elevated platforms. After the support trailers were relocated to the north end of the Site, Sampling Station 1 was placed on the roof of the office trailer.

Air monitoring included operating an on-site meteorological station. The station was located in the support area with sensors mounted on a mast near the health and safety trailer. The weather station was replaced and upgraded in 1995 prior to the beginning of S/S processing.

Perimeter air monitoring measured the following characteristics on a daily basis:

- Total suspended particulates (TSP)
- Total suspended particulates equal to or less than 10 microns in diameter (PM 10)
- Total long-lived airborne alpha emitting radionuclides considered as Thorium 230.

The concentration of airborne metals, arsenic, selenium, and lead, were measured each week during S/S processing and placement, with the exception of the first three weeks where the samples were analyzed for molybdenum, selenium and lead.

Additional analysis was performed when the net downwind concentration of airborne long-lived alpha particle emitters considered as Thorium 230 was in excess of the effluent limit for this radionuclide. A portion of the TSP sample for the station exhibiting elevated alpha particle activity was submitted for analysis of uranium, Thorium-230, and Radium-226.

Air Monitoring Instrumentation

Detailed descriptions of the air monitoring instrumentation are set forth below.

Meteorological Station

Earth Sciences replaced and upgraded the meteorological station during the shutdown period. The upgraded meteorological station conformed with National Oceanographic and Atmospheric Administration (NOAA) requirements for generation of data for use in national weather reporting and statistical data accumulation programs.

The meteorological station instruments were factory-calibrated prior to installation. The wind direction sensor was aligned using a magnetic compass compensated for local magnetic deflection as shown on the USGS quadrangles, 39104 (Englewood) and 39105 (Fort Logan) .

Shortly after the commencement of Phase II construction operations, the anemometer and thermometer were recalibrated. The anemometer was calibrated using an independently calibrated rotometer. The thermometer was recalibrated with a National Institute of Science and Technology (NIST) traceable primary standard thermometer.

TSP Samplers

TSP samples were obtained using Graseby/GMW TSP samplers. Each TSP sampler, except for Sampling Station 1, was placed on an elevated platform to allow the sampling surface to be approximately 2 meters off the ground surface. Sampling Station 1 was located on top of a support trailer.

TSP samplers were calibrated weekly using multiple resistance plates in the sampling orifice and an open-tube manometer to measure the pressure drop in the calibration chamber as a function of the applied mechanical resistance. The calibrating orifice was standardized against an NIST traceable primary standard.

The calibration of the TSP samplers was checked between calibrations using a different NIST traceable calibrating orifice from the one used in the weekly calibration.

TSP samples were obtained each operating day and on nonoperating days, when possible, for a 24 hour period plus or minus ½ hour as required by EPA's reference method for TSP sampling. Flow rates during the sampling period were recorded using a Dickson Flow Recorder.

TSP samples were collected on 8-inch by 10-inch glass fiber filters. The filters were collected at the end of the sampling period and submitted for gravimetric analysis of the retained particulate matter.

PM_{10} Samplers

Graseby/GMW PM_{10} samplers were located adjacent to the TSP samplers at each of the five sampling stations. The samplers were calibrated by the same means and at the same frequency as the TSP samplers. The silicone film on the impinger plate was cleaned and replaced periodically. The sampling period and sampling frequency for PM_{10} samples was the same as for TSP sampling.

PM_{10} samples were collected on 8-inch by 10-inch quartz fiber filters. The filters were collected at the end of the sampling period and submitted for gravimetric analysis of the retained particulate matter. Samples for analysis of airborne metals and specific radionuclides were obtained from the TSP filters.

RAS Samplers

RAS Samplers manufactured by Eberline Instruments, Inc. operated continually at 60 liters per minute. The RAS Samplers were located at each of the perimeter air monitoring stations, and were operated for the same frequency and duration as the particulate samplers. RAS samplers were used to obtain samples for determination of total long-lived alpha particle concentration. The samplers collected airborne radionuclides on a 2-inch glass fiber filter analyzed on site for total alpha particle activity after a holding period for decay of any radon daughters.

Maintenance of Air Sampling Equipment

The particulate sampling equipment was evaluated daily for maintenance and was maintained as necessary. Typically, variations in flow indicated the need for service on a unit. Earth Sciences replaced motor brushes on a regularly scheduled basis and as needed. A supply of spare blower motors, flow recording charts, recording pens, timers, and mass flow controllers was maintained on the Site at all times to keep the sampling equipment operational.

HEALTH AND SAFETY INSTRUMENTATION

Health and Safety Instrumentation

Detailed descriptions of the health and safety instrumentation are set forth below.

Personal Sampling Pumps

Belt-mounted portable personal sampling pumps were used for general purpose exposure monitoring. AWS Remediation utilized SKC personal sampling pumps with an adjustable sampling rate of 0.1 to approximately 3 liters per minute. The pumps were used for sampling airborne dust for radon and long-lived alpha emitting radionuclides.

Real Time Ambient Dust Monitor

Mini-Rom Aerosol Monitor, Model PBM-3 real time dust monitoring equipment was used to measure ambient respirable dust. The devices detect airborne dust with a diameter of 10 microns or less and provide real time direct measurements.

Ammonia Monitor

An ammonia monitor was used to determine employee exposure to ammonia gas. Some of the soils at the Bannock Street Site contained unknown ammonium compounds that released ammonia gas when treated with cement and fly ash. The monitor provided real time measurements of ammonia to determine respiratory protection for employees working in the vicinity of recently prepared S/S material.

Instrument Maintenance and Calibration

Minor maintenance of the Health and Safety instruments was performed including replacement of batteries and other user-serviceable parts. Maintenance that could not be performed on the Site was performed by the manufacturer.

The ammonia detector and dust monitor used by Earth Sciences were factory calibrated and did not require additional calibration during the course of the project. Calibration of personal sampling pumps was performed each time the pumps were placed into service. Calibration was performed using a primary standard BIOS dry type calibrator to measure sampler flow rate immediately before the beginning of a sampling event and at the end of the sampling event. An average flow rate for the entire sampling event was calculated from the two values. The BIOS dry calibrator is a primary reference calibration standard and does not require secondary calibration.

Personal (Worker) Survey Instrumentation

Radiological surveys were performed with the alpha scintillator and the beta-gamma meter to monitor for personal contamination each time the employee left the Exclusion Zone (where radioactive impacted soils were present). Employees were frisked before leaving the Site by passing both the alpha scintillator and the beta-gamma meter over their hands and feet. NRC criteria were used.

Clean Area Survey Instrumentation

Weekly clean area surveys were conducted in each of the trailers to ensusre that the clean areas remained uncontaminated. An alpha scintillator, a beta-gamma meter and a micro-R survey meter were used for this purpose. Several one-minute count readings were taken in each of the trailers. In addition to the instrument readings, swipe samples were taken at each sampling location in the trailers. These swipe samples were analyzed in the dual channel analyzer to simultaneously count alpha and beta-gamma activity.

RESULTS OF LEACHABILITY AND STRENGTH TESTS FOR OIL-IMPACTED SOILS

ONE POINT MOISTURE - DENSITY RELATIONS OF SOIL-CEMENT MIXTURES AND COMPRESSIVE STRENGTH CYLINDERS

RA Construction

S.W. Shattuck Chemical Company

Denver Radium Site, Operable Unit VIII

Sample No.: ESP047/011-11/12-1130 Type of Sample: BULK

Sample Location: 011-ESP047 STOCK-PILES Date: 11/12/96 Time: 1130

○ ASTM D558, Utilizing Standard Methodology

● ASTM D558, Modified by Using ASTM D1557 Compaction Energy

○ Method A

● Method B

COMPACTION DATA

Run No.		One Point	Cylinders 1	2	3	4	5	6
(1) Wet Weight of Sample + Mold	g	6602.5	6440.7	6485.8	6437.1	6458.0	6443.4	6411.7
(2) Weight of Mold	lb	9.87	9.61	9.70	9.62	9.63	9.56	9.49
(3) Wet Weight of Sample (1) - (2)	lb	4.69	4.59	4.60	4.57	4.61	4.65	4.65
(4) Volume of Mold	ft^3	1/30	1/30	1/30	1/30	1/30	1/30	1/30
(5) Wet Density (3) ÷ (4)	lb/ft^3	140.7	137.7	138.0	137.1	138.3	139.5	139.5
(6) Dry Density (5) ÷ [1 + (12)/100]	lb/ft^3	123.5	120.9	121.2	120.4	121.4	122.5	122.5

MOISTURE CONTENT DATA

Container No.		10A						
(7) Wet Weight of Sample + Container	g	562.6						
(8) Dry Weight of Sample + Container	g	509.2						
(9) Weight of Moisture (7) - (8)	g	53.4						
(10) Weight of Container	g	126.4						
(11) Net Weight of Dry Sample (8) - (10)	g	382.8						
(12) Moisture Content [(9) ÷ (11)] x 100	%	13.9						

Comments:

Rev. 08/28/96

Tested By: C. Conrod Date: 11/12/96

Checked By: M. Aenfour Date: 11/12/96

JA CESARE and Associates, Inc.

Geotechnical Engineering Consultants

COMPRESSIVE STRENGTH OF SOIL-CEMENT CYLINDERS
(ASTM C39)

Project No. ______ Project Name: SHATTUCK

Cylinder Identification: ESP047/OIL - 11/12 - 1130 - (#1)

Length: L_1 = 4.6100 in. | Diameter: D_1 = 4.025 in.

L_2 = 4.6070 in. | D_2 = 4.025 in.

L_3 = 4.6110 in. | D_3 = 4.024 in.

L_{avg} = 4.6093 in. | D_{avg} = 4.025 in.

L/D = 1.15 | AREA: = 12.72 in²

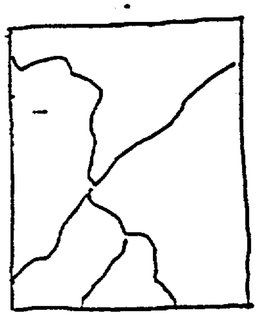
Date of Test: 11/15/96 Time of Test: 1037 - 1044

Tested by: L Jansen / [illegible]

Maximum load: 16580 lbs. Strength: 1303.5 psi

Description of Defects: bumpy top; smooth bottom w/rough edges; a couple small cracks / patchy spots along sides

Description of Fracture:



[signature] 11/15/96

CONCRETE

J.A. CESARE AND ASSOCIATES, INC.
Geotechnical Engineering Consultants

COMPRESSIVE STRENGTH OF SOIL-CEMENT CYLINDERS
(ASTM C39)

Project No. ________ Project Name: SHATTUCK

Cylinder Identification: ESP047/OIL-11/12-1130-(#2)

Length: L_1 = 4.6300 in.
L_2 = 4.5990 in.
L_3 = 4.6145 in.
L_{avg} = 4.6145 in.
L/D = 1.15

Diameter: D_1 = 4.025 in.
D_2 = 4.016 in.
D_3 = 4.021 in.
D_{avg} = 4.021 in.
AREA: = 12.69 in²

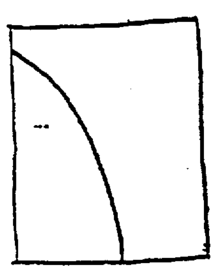
Date of Test: 11/19/96 Time of Test: 0830-0836

Tested by: [signature]

Maximum load: 23780 lbs. Strength 1873.9 ✓ psi

Description of Defects: smooth top and bottom w/good edges; no visible defects along sides ✓

Description of Fracture:



✓

[signature]
11/19/96

CONCRETE

J.A. CESARE and Associates, Inc.

Geotechnical Engineering Consultants

COMPRESSIVE STRENGTH OF SOIL-CEMENT CYLINDERS
(ASTM C39)

Project No. ____________ Project Name: SHATTUCK

Cylinder Identification: FSP047/011-11/12-1130-(#3)

Length: L_1 = 4.6245 in

L_2 = 4.6060 in

L_3 = 4.6145 in

L_{avg} = 4.6150 in

L/D = 1.15

Diameter: D_1 = 4.028 in.

D_2 = 4.025 in.

D_3 = 4.025 in.

D_{avg} = 4.026 in.

AREA: = 12.72 in²

Date of Test: 12/10/96

Time of Test: High Cell* 1630 - 1642
0838 - 0840

Tested by: [signature]

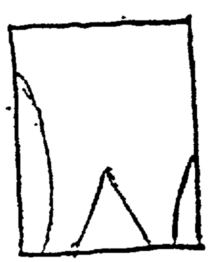
Maximum load: >30000 lbs.
31400*

Strength: >2358.5 psi
2468.6*

Description of Defects: smooth top and bottom; small chips in upper edge; a few small rough spots along sides

Description of Fracture:

No fracture on low cell



✓ by M. [signature] 12/10/96

CONCRETE

Accu-Labs® Research, Inc.
4663 Table Mountain Drive Golden, Colorado 80403-1650
(303) 277-9514 FAX (303) 277-9512

Date: 12/27/96
Page 1

REPORT OF ANALYSIS

Mr Paul Taylor
Earth Sciences
565 E 70th Ave
Unit 1W
Denver, CO 80229

Lab Job Number: 012900 EAR002
Date Samples Received: 12/10/96

ALR Designation:	96-A25936
Client Designation:	FSP047/OIL-11/12-1130-#4
Sample Location:	
Location II:	
Date/Time Collected	11/12/96 11:30
Uranium, total (mg/L)	< 0.005
Radium-226, total (pCi/L)	2.5 +/- 0.9
Thorium-230, total (pCi/L)	0.1 +/- 0.3

NOTES: When present, *** indicates that the analyte in question was not requested for that sample.

Variability of the radioactive disintegration process (counting error) at the 95% confidence level is 1.96 sigma and the level of significance may exceed that of the reported analytical result.

Scheduled sample disposal/return date: January 26, 1997.

Bud Summers
Radiochemistry Supervisor

Accu-Labs® Research, Inc.
4663 Table Mountain Drive Golden, Colorado 80403-1650
(303) 277-9514 FAX (303) 277-9512

Date: 12/27/96
Page 1

REPORT OF ANALYSIS

Mr Paul Taylor
Earth Sciences
565 E 70th Ave
Unit 1W
Denver, CO 80229

Lab Job Number: 012900 EAR002
Date Samples Received: 12/10/96

ALR Designation:	96-A25936
Client Designation:	FSP047/OIL-11/12-1130-#4
Sample Location:	
Location II:	
Date/Time Collected	11/12/96 11:30
Total Organic Carbon (mg/L)	< 1
Total Petroleum Hydrocarbons (mg/L)	2.0

Notes: When present, *** indicates that the analyte in question was not requested for that sample.

Scheduled sample disposal/return date: January 26, 1997.

Trudy L. Scott

Eyda Hergenreder
Trudy L. Scott
Laboratory Managers

Accu-Labs® Research, Inc.
4663 Table Mountain Drive Golden, Colorado 80403-1650
(303) 277-9514 FAX (303) 277-9512

Date: 12/27/96
Page 1

REPORT OF ANALYSIS

Mr Paul Taylor
Earth Sciences
565 E 70th Ave
Unit 1W
Denver, CO 80229

Lab Job Number: 012900 EAR002
Date Samples Received: 12/10/96

ALR Designation:	96-A25936
Client Designation:	FSP047/OIL-11/12-1130-#4
Sample Location:	
Location II:	
Date/Time Collected	11/12/96 11:30
Arsenic, Total (mg/L)	< 0.05
Lead, Total (mg/L)	< 0.05
Selenium, Total (mg/L)	< 0.05

NOTES: When present, *** indicates that the analyte in question was not requested for that sample.

Scheduled sample disposal/return date: January 26, 1997.

Trudy L. Scott

Eyda Hergenreder
Trudy L. Scott
Laboratory Managers

Accu-Labs Research, Inc.
4663 Table Mountain Drive - Golden, CO 80403-1650 - (303) 277-9514

ate: 12/10/96
age: 1

SAMPLE ACKNOWLEDGEMENT
ALR JOB NUMBER: 012900

T : Mr Paul Taylor
Earth Sciences
565 E 70th Ave
Unit 1W
Denver, CO 80229

CLIENT PROJECT NO: 886F-F3
SAMPLES RECEIVED: 12/10/96, 16:00
CLIENT P.O. No.: NONE

ccu-Labs sample ID	Client Sample ID	Date/Time Collected	Comments
6-A25936 Solid	FSP047/OIL-11/12-1130-#4	11/12/96,11:30	

Anticipated Completion Date: 12/30/96

Additional Notes

Samples were received intact unless noted.
The original chain of custody forms received are attached for your files.

Please contact the Customer Service Department if you have questions regarding these samples.

CHAIN OF CUSTODY RECORD

$\emptyset$1.$\emptyset\emptyset$

Return White Copy T

PROJECT NO. 886F-F3
PROJECT NAME Shattuck
CONTROL No 587

Name: Raul Taylor
Title: QA MGR.
Company: ESC
Address: 565 E. 70th Ave Ste 1W Denver 80229
Telephone: 303-763-9000

ANALYSES: Extractable As, Se, Pb, U, Th-230, Ra-226

SAMPLE NUMBER	DATE	TIME	SAMPLE LOCATION	SAMPLE TYPE	NUMBER OF CONTAINERS	As	Se	Pb	U	Th-230	Ra-226		REMARKS/SPECIAL INSTRUCTIONS
FSP047/02L-11/12-1130-#4	11/12	1130	Oily Dirt Pile	MaD	1	X	X	X	X	X	X	X	USE ASTM D-3987

SAMPLED BY (sign) [signature] / [signature] / /

RELINQUISHED BY (sign)	RELINQUISHED BY (sign)	RELINQUISHED BY (sign)	RELINQUISHED BY (sign)
1. [signature] DATE/TIME (12/10/96 1000)	2. Dan Hartwell DATE/TIME (12/10/96 1600)	3. DATE/TIME (/)	4. DATE/TIME (/)
RECEIVED BY (sign)	RECEIVED BY (sign)	RECEIVED BY (sign)	RECEIVED BY (sign)
1. Dan Hartwell DATE/TIME (12/10/96 1015)	2. DATE/TIME (/)	3. DATE/TIME (/)	4. DATE/TIME (/)

METHOD OF SHIPMENT/WAY BILL NO.	SHIPPED BY (sign)	RECEIVED FOR LABORATORY BY (sign)	DATE/TIME
		Don Manning	12/10/96 1600

Original - Shipped with samples and returned to shipper - Yellow - Laboratory - Pink - Shipper

Earth Sciences Consultants, Inc. 5613 DTC Parkway Suite 630 Englewood, C.O. 80111

Form 8001 / 1993

WELL INSTALLATION AND DEVELOPMENT

Well Installation

Between June 3 and June 10, 1998, ten monolith monitoring wells (USE-1 through USE-5, DSE-1 through DSE-5) and one plume monitoring well (APM-1) were installed at the locations shown on Figure X. The monitoring wells were installed in accordance with project plans. The borings for the wells were drilled by Layne-Christensen Company (Layne), Denver, Colorado. Prior to drilling, surface soils and the drilling equipment were screened for radiation using a Victoreen THYAC IV Model 290 radiation meter. Background soil radiation levels ranged from 6 to 7 counts per minute. The augers had radiation levels between 2 and 3 counts per minute, well below background soil concentrations.

The borings were drilled using a truck-mounted Mobile B57 drill rig equipped with 8.5-inch diameter hollow-stem augers to a maximum depth of 22.5 feet below ground surface (bgs). The borings were continuously sampled using a 4-inch-diameter, 5-foot-long split spoon sampler, and were logged by an HLA geologist. Samples were screened for volatile organic compounds (VOCs) using a Minirae photoionization detector (PID), and for radiation using a Victoreen THYAC IV Model 290 radiation meter. VOC and radiation concentrations were recorded on the boring logs. Soil and rock were classified in accordance with criteria specified in Addendum Number 1 to the Phase II SAP.

Groundwater monitoring wells were constructed using 2-inch-diameter flush-threaded Schedule 80 polyvinyl chloride (PVC) well casing and screen fitted with a bottom well cap. The well screen for the monolith monitoring wells was placed in the boring so that the bottom of the well screen is coincident with the alluvium/Denver Formation contact. The 2.5-foot annular space below the alluvium/Denver Formation contact was sealed by placing bentonite slurry through a tremie pipe to the alluvium/Denver Formation contact. The well screen for plume well APM-1 was placed so that approximately five feet of well screen extends below the water table. The annular space around the well screen was filled with a sand filter pack of Colorado silica sand to a depth of approximately 2 feet above the well screen. An approximately 2-foot-thick bentonite pellet seal was placed above the sand filter pack and was hydrated with water. The remainder of the annulus was filled with a cement-bentonite grout. A locking well cap J-plug was installed in the top of the well casing. A flush-mounted traffic-rated vault was installed around each wellhead to protect it from surface traffic.

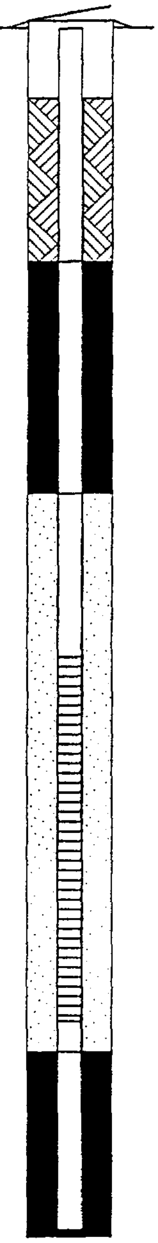
Cuttings produced during borehole drilling were temporarily containerized in a U.S. Department of Transportation (DOT)-approved, open top, 55-gallon drum. As approved by the EPA, the cuttings were then emptied on the north side of the Site, north of the monolith.

Well Development

The monitoring wells were developed between June 10 and June 12, 1998, in accordance with procedures described in the Addendum Number 1 to the Phase II SAP. Wells DSE-1and DSE-2 were dry at the time well development was conducted. The wells were developed by Layne using a combination of surging and bailing. Measurements of temperature, conductivity, pH, and turbidity were collected during well development and recorded on field data sheets. Purged water produced during well development was containerized in labeled, DOT-approved, open top, 55-gallon drums provided by Layne. Filled drums were sealed and temporarily stored onsite until receipt of the laboratory analytical data from the first round of groundwater sampling.

TOP OF CASING
ELEVATION ________ ft.

GROUND SURFACE



Top of casing 0 feet below ground level
8.5-in.dia. Borehole 0 to 15.6 ft.
2-in.dia. Schedule 80 PVC blank casing 0 to 8.1 ft.
Cement sand seal 0.9 to 3.0 ft.

Bentonite pellet seal 3.0 to 6.0 ft.

CSSI 16-40 Sand pack 6.0 to 13.2 ft.

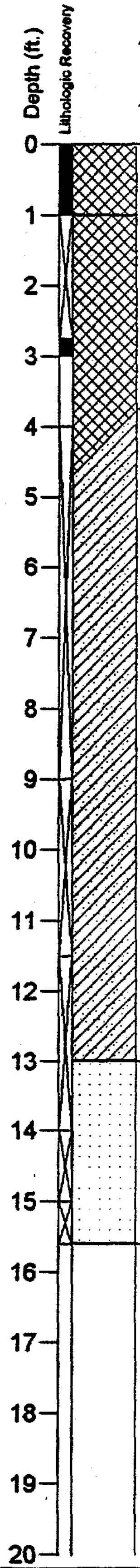
2-in.dia. Slotted (0.010-in.) screen 8.1 to 12.8 ft.

2-in.dia. Schedule 80 PVC blank silt trap 12.8 to 15.5 ft.
Bentonite pellet seal 13.2 to 15.6 ft.

Bottom well cap 15.5 ft.
Hole cleaned out to 15.6 ft.
Bottom of borehole 15.6 ft.

EQUIPMENT B-59

ELEVATION ________ *DATE* 6/9/98



Depth (ft.)	Description
0	GRAVEL FILL
1	COBBLE/BOULDER (RIP RAP) FILL
4	DARK BROWN CLAYEY SAND, dry, mostly fine sand, some clay, alluvium
6	Same as above with fine to corase gravel
13	YELLOWISH BROWN SANDSTONE, moist, weak, low hardness, deeply weathered, Denver Formation
15.6	Total Depth = 15.6 feet.

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Log of Boring, and
Well Completion Diagram, DSE-1
Denver Radium Site
Operable Unit VIII
Denver, Colorado

FIGURE
1

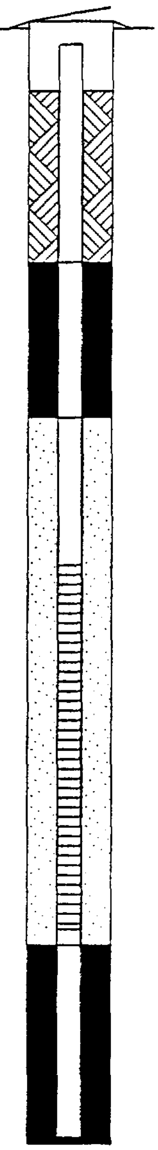
DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
LDZ	38923.3		7/1/98	

TOP OF CASING
ELEVATION ________ ft.

EQUIPMENT B-59

ELEVATION ________ DATE 6/9/98

GROUND SURFACE



Top of casing 0.2 feet below ground level
8.5-in.dia. Borehole 0 to 14.4 ft.
2-in.dia. Schedule 80 PVC blank casing 0.2 to 6.9 ft.
Cement sand grout 0.8 to 3.0 ft.

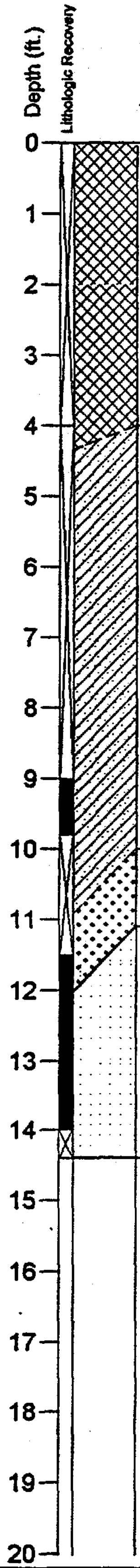
Bentonite pellet seal 3.0 to 5.0 ft.

CSSI 16-40 Sand pack 5.0 to 11.8 ft.

2-in.dia. Slotted (0.010-in.) screen 6.9 to 11.6 ft.

2-in.dia. Schedule 80 PVC blank silt trap 11.6 to 14.3 ft.
Bentonite pellet seal 11.8 to 14.4 ft.

Bottom well cap 14.3 ft.
Hole cleaned out to 14.4 ft.
Bottom of borehole 14.4 ft.



GRAVEL FILL

RIP RAP, Cobbles and Small Boulders (6-18 inches diameter)

DARK BROWN CLAYEY SAND, fine to coarse sand with fine to coarse gravel

SAND (SW), wet, loose, mostly fine to coarse sand, few fine to coarse gravel, few fines, Alluvium

YELLOWISH BROWN SANDSTONE, moist, weak, low hardness, deeply weathered, mostly fine sand, slight iron oxide staining
DEEPLY WEATHERED BEDROCK, DENVER FORMATION
Concentration increasing with depth, becomes hard, blue-gray, little weathered by 14.0 feet.

Total Depth = 14.4 ft.

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Log of Boring, and Well Completion Diagram, DSE-2
Denver Radium Site
Operable Unit VIII
Denver, Colorado

FIGURE
2

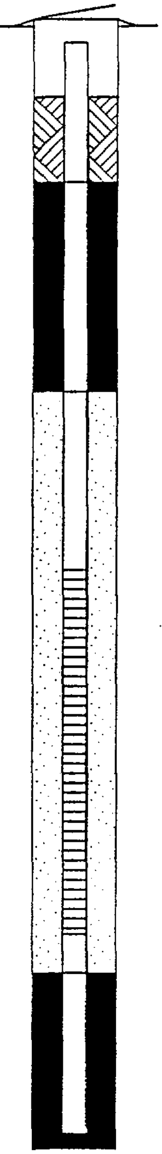
DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
LDZ	38923.3		7/1/98	

TOP OF CASING
ELEVATION ________ ft.

EQUIPMENT B-59

ELEVATION ________ DATE 6/9/98

GROUND SURFACE



Top of casing 0.2 feet below ground level
8.5-in.dia. Borehole 0 to 14.5 ft.
2-in.dia. Schedule 80 PVC blank casing 0.2 to 7.0 ft.
Cement seal grout 0.9 to 2.0 ft.

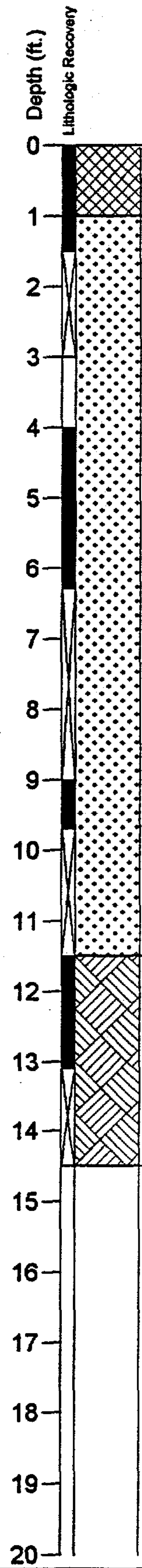
Bentonite pellet seal 2.0 to 4.7 ft.

CSSI 16-40 Sand pack 4.7 to 12.2 ft.

2-in.dia. Slotted (0.010-in.) screen 7.0 to 11.7 ft.

2-in.dia. Schedule 80 PVC blank silt trap 11.7 to 14.3 ft.
Bentonite pellet seal 12.2 to 14.5 ft.

Bottom well cap 14.3 ft.
Hole cleaned out to 14.5 ft.
Bottom of borehole 14.5 ft.



GRAVEL FILL, loose, 1.5 inch diameter gravel

REDDISH BROWN SAND (SW), wet, loose, mostly fine to coarse sand, few silt, fill

Increasing coarseness with depth, Alluvium

Increasing gravel content

GRAYISH YELLOWISH BROWN CLAYSTONE, soft to low hardness, friable, moist, deeply weathered bedrock, DENVER FORMATION

Total Depth = 14.5 ft.

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Log of Boring, and
Well Completion Diagram, DSE-3
Denver Radium Site
Operable Unit VIII
Denver, Colorado

FIGURE
3

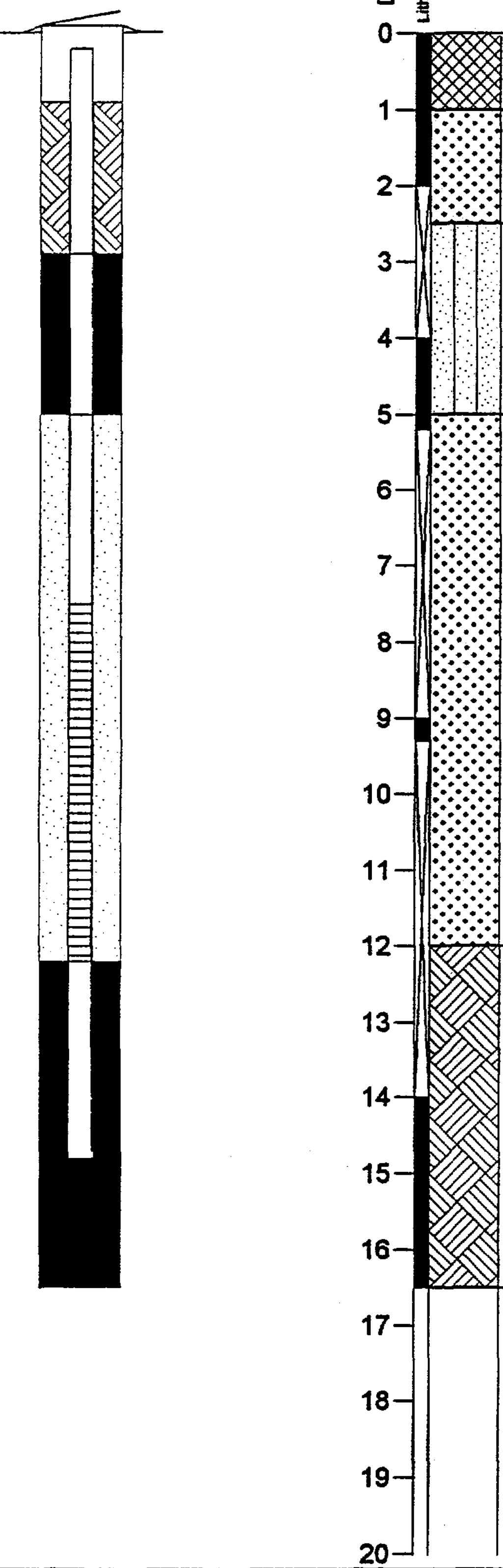
DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
LDZ	38923,3		7/1/98	

TOP OF CASING
ELEVATION ________ ft.

EQUIPMENT B-59

ELEVATION ________ DATE 6/9/98

GROUND SURFACE



Well construction	Depth (ft.)	Description
Top of casing 0.2 feet below ground level 8.5-in.dia. Borehole 0 to 16.5 ft. 2-in.dia. Schedule 80 PVC blank casing 0.2 to 7.5 ft. Cement sand grout 0.9 to 2.9 ft.	0–1	GRAVEL FILL, loose, 1.5 inch diameter gravel
	1–2.5	REDDISH BROWN WELL GRADED SAND (SW), wet, loose, mostly fine to coarse sand, trace fine to coarse gravel. fill
Bentonite pellet seal 2.9 to 5.0 ft.	2.5–5	DARK GRAYISH SILTY SAND (SM), moist, loose, mostly sand, some silt, trace clay, Alluvium
CSSI 16-40 Sand pack 5.0 to 12.4 ft. 2-in.dia. Slotted (0.010-in.) screen 7.5 to 12.2 ft.	5–12	REDDISH BROWN WELL GRADED SAND (SW), mosit, fine to coarse sand, few fine to coarse gravel, Alluvium
2-in.dia. Schedule 80 PVC blank silt trap 12.2 to 14.8 ft. Bentenite pellet seal 12.4 to 16.5 ft. Bottom well cap 14.8 ft.	12–16.5	YELLOWISH BROWN GRAY CLAYSTONE, weak, low hardness, deeply weathered, slight iron oxide staining, mostly clay, little very fine sand, moderately fractured, Denver Formation
Hole cleaned out to 16.5 ft. Bottom of borehole 16.5 ft.	16.5	Total Depth = 16.5 ft.

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Log of Boring, and
Well Completion Diagram, DSE-4
Denver Radium Site
Operable Unit VIII
Denver, Colorado

FIGURE **4**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
LDZ	38923.3		7/1/98	

TOP OF CASING
ELEVATION ________ ft.

GROUND SURFACE

Top of casing 0 feet below ground level
8.5-in.dia. Borehole 0 to 14.5 ft.
2-in.dia. Schedule 80 PVC blank casing 0 to 6.2 ft.
Cement sand grout 0.9 to 2.0 ft.

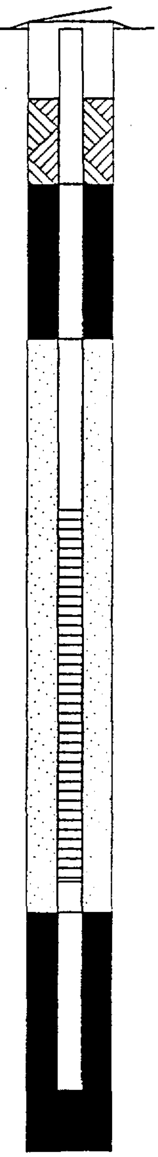
Bentonite pellet seal 2.9 to 4.0 ft.

CSSI 16-40 Sand pack 4.0 to 11.4 ft.

2-in.dia. Slotted (0.010-in.) screen 6.2 to 11.0 ft.

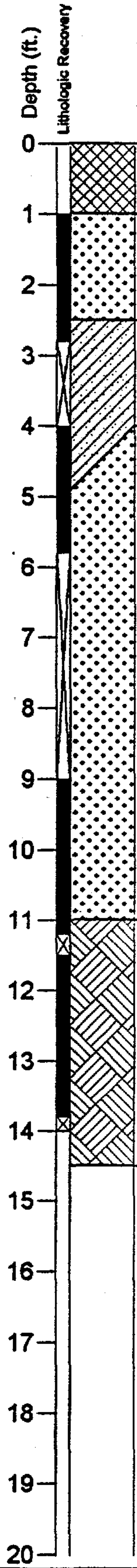
2-in.dia. Schedule 80 PVC blank silt trap 11.0 to 13.7 ft.
Bottom well cap 13.7 ft.

Bentonite pellet seal 11.4 to 14.5 ft.
Hole cleaned out to 13.7 ft.
Bottom of borehole 14.5 ft.



EQUIPMENT B-59

ELEVATION ________ DATE 6/9/98



Depth (ft.)	Description
0	GRAVEL FILL, loose, 1.5 inch diameter gravel
1	REDDISH BROWN WELL GRADED SAND (SW), wet, loose, mostly fine to coarse sand, trace fine to coarse gravel, fill
2.5	DARK REDDISH BROWN CLAYEY SAND (SC), moist, medium dense, mostly fine to coarse sand, some clay and silt, trace fine to coarse gravel, fill
4.2	REDDISH BROWN WELL GRADED SAND (SW), moist, loose, mostly fine to coarse sand, trace fine gravel Increasing gravel content at 6 feet
11	YELLOWISH BROWN CLAYSTONE, moist, weak, low hardness, deeply weathered, Denver Formation
14.5	Total Depth = 14.5 ft.

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Log of Boring, and Well Completion Diagram, DSE-5
Denver Radium Site
Operable Unit VIII
Denver, Colorado

FIGURE **5**

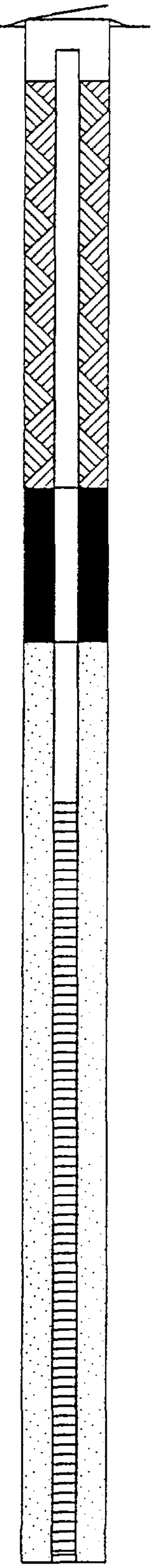
DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
LDZ	38923,3		7/1/98	

TOP OF CASING
ELEVATION ________ ft.

EQUIPMENT B-59

ELEVATION ________ DATE 6/9/98

GROUND SURFACE

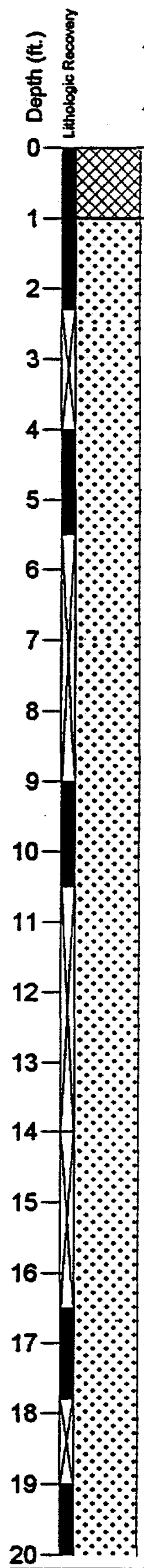


Top of casing 0.3 feet below ground level
8.5-in.dia. Borehole 0 to 23.0 ft.
2-in.dia. Schedule 80 PVC blank casing 0.3 to 23.0 ft.
Cement sand grout 0.7 to 6.0 ft.

Bentonite pellet seal 6.0 to 8.0 ft.

CSSI 16-40 Sand pack 8.0 to 20.3 ft.

2-in.dia. Slotted (0.010-in.) screen 10.1 to 19.9 ft.



GRAVEL FILL, loose, 1.5 inch diameter gravel

REDDISH BROWN WELL GRADED SAND (SW), moist, loose, mostly fine to coarse sand, trace fine coarse gravel, fill, Alluvium

Increasing gravel content

Becoming wet

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Log of Boring, and
Well Completion Diagram, USE-1
Denver Radium Site
Operable Unit VIII
Denver, Colorado

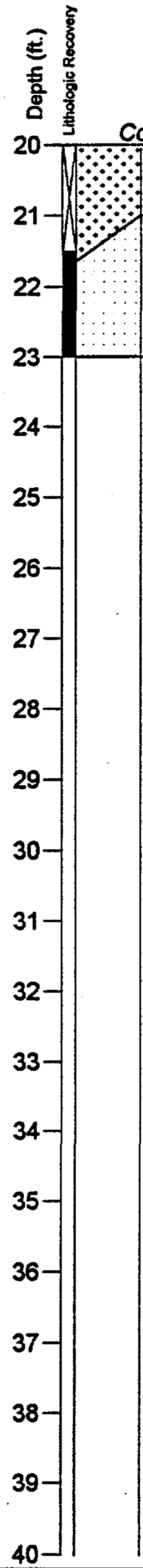
FIGURE
6

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
LDZ	38923,3		7/1/98	

Continuation of Well

2-in.dia. Schedule 80 PVC blank silt trap 19.9 to 22.6 ft.
Bentinte pellet seal 20.3 to 23.0 ft.

Bottom well cap 22.6 ft.
Hole cleaned out to 22.6 ft.



Continuation of Log

YELLOW BROWN SANDSTONE, wet, mostly fine sand, some clay, deeply weathered bedrock, Denver Formation

Total Depth = 23.0 ft.

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**Log of Boring, and
Well Completion Diagram, USE-1**
Denver Radium Site
Operable Unit VIII
Denver, Colorado

FIGURE
6

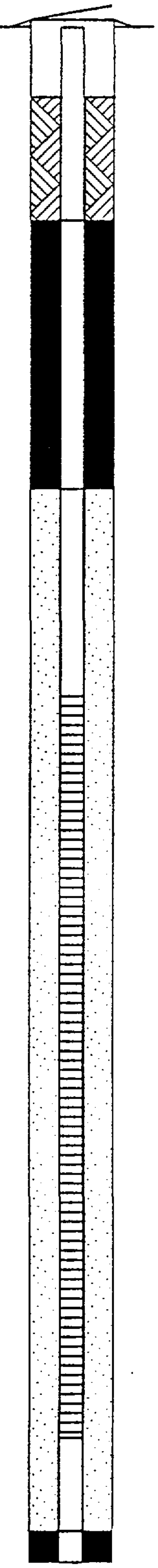
DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
LDZ	38923,3		7/1/98	

TOP OF CASING
ELEVATION ________ ft.

EQUIPMENT B-59

ELEVATION ________ DATE 6/9/98

GROUND SURFACE



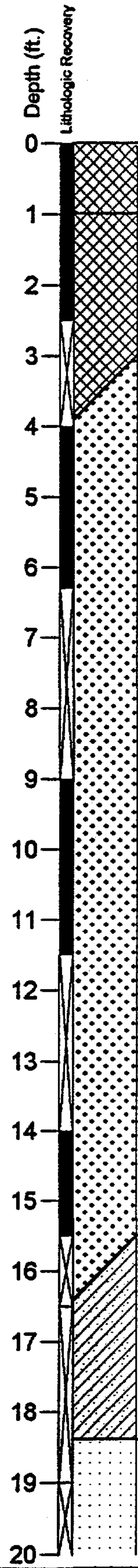
Top of casing 0 feet below ground level
8.5-in.dia. Borehole 0 to 22.4 ft.
2-in.dia. Schedule 80 PVC blank casing 0 to 8.7 ft.
Cement sand seal 0.9 to 2.5 ft.

Bentonite pellet seal 2.5 to 6.0 ft.

CSSI 16-40 Sand pack 6.0 to 19.6 ft.

2-in.dia. Slotted (0.010-in.) screen 8.7 to 18.4 ft.

2-in.dia. Schedule 80 PVC blank silt trap 18.4 to 21.1 ft.



GRAVEL FILL

COBBLES/BOULDER FILL (RIP RAP)

REDDISH BROWN SAND (SW), moist, loose, fine to coarse sand, few fine gravel, trace coarse gravel

Increasing gravel content

REDDISH YELLOW BROWN CLAYEY SAND (SC), wet, loose, mostly fine to coarse sand, some clay, subrounded, Alluvium

YELLOWISH BROWN SANDSTONE, moist, weak, low hardness, mostly fine sand, trace medium sand, some clay, deeply weathered,

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Log of Boring, and Well Completion Diagram, USE-2
Denver Radium Site
Operable Unit VIII
Denver, Colorado

FIGURE
7

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
LDZ	38923.3		7/1/98	

Continuation of Well

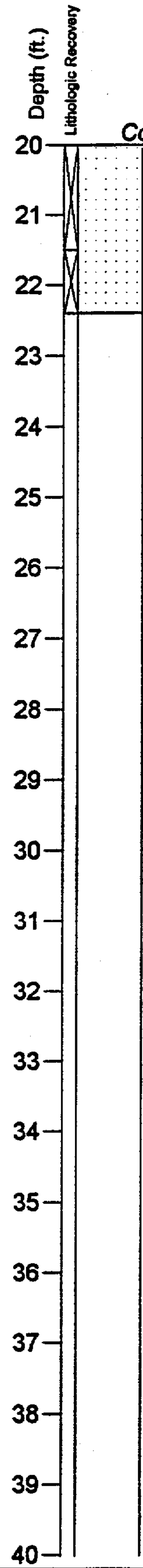
Bentonite pellet seal 19.6 to 22.4 ft.

Bottom well cap 21.1 ft.

Hole cleaned out to 21.5 ft.

Bottom of borehole 22.4 ft.

Continuation of Log



Denver Formation

Total Depth = 22.4 ft.

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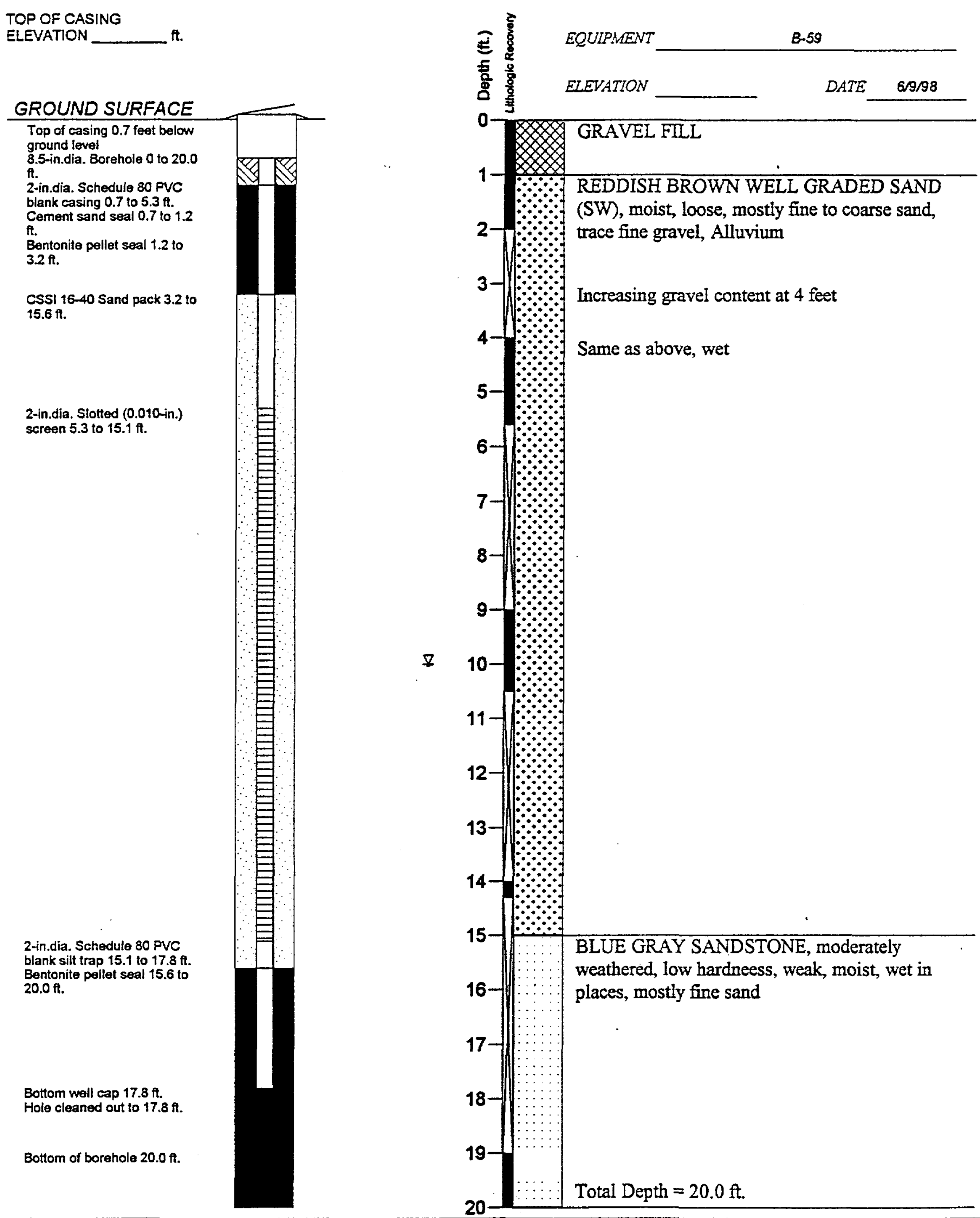
Log of Boring, and
Well Completion Diagram, USE-2
Denver Radium Site
Operable Unit VIII
Denver, Colorado

FIGURE
7

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
LDZ	38923.3		7/1/98	



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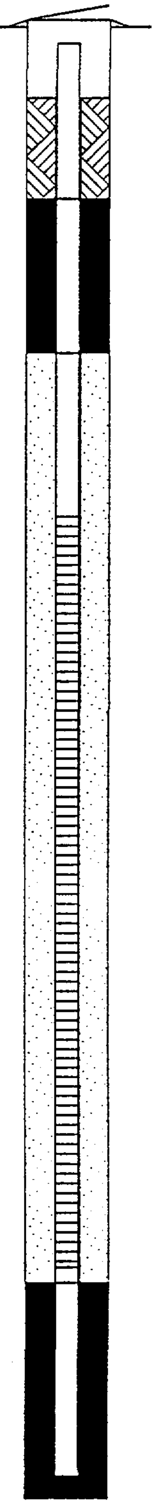
Log of Boring, and
Well Completion Diagram, USE-3
Denver Radium Site
Operable Unit VIII
Denver, Colorado

FIGURE
8

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
LDZ	38923,3		7/1/98	

TOP OF CASING
ELEVATION ________ ft.

GROUND SURFACE



Top of casing 0.2 feet below ground level
8.5-in.dia. Borehole 0 to 19.0 ft.
2-in.dia. Schedule 80 PVC blank casing 0.2 to 6.3 ft.
Cement sand seal 0.9 to 2.2 ft.
Bentonite pellet seal 2.2 to 4.2 ft.

CSSI 16-40 Sand pack 4.2 to 16.2 ft.

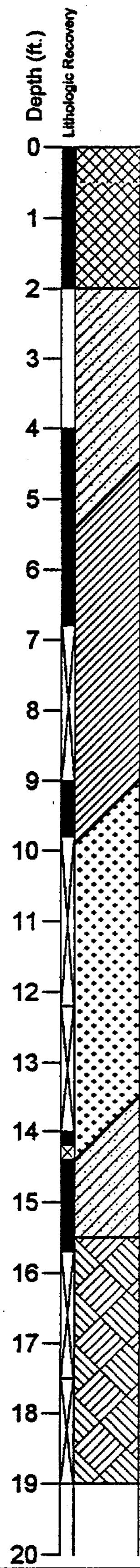
2-in.dia. Slotted (0.010-in.) screen 6.3 to 16.0 ft.

2-in.dia. Schedule 80 PVC blank silt trap 16.0 to 18.7 ft.
Bentonite pellet seal 16.2 to 19.0 ft.

Bottom well cap 18.7 ft.
Hole cleaned out to 18.7 ft.
Bottom of borehole 19.0 ft.

EQUIPMENT B-59

ELEVATION ________ *DATE* 6/9/98



Depth (ft.)	Description
0	GRAVEL FILL, 1.5 inch diameter FILL (RIP RAP), large cobble to boulder size angular rock
2	DARK BROWN CLAYEY SAND (SC), wet, medium dense, mostly fine sand, little medium sand, some clay and silt, trace coarse sand
4.5	DARK BROWN SANDY CLAY (CL),moist, medium dense, mostly clay, some fine sand, some silt, trace medium to coarse sand, Alluvium Increasing gravel at 8.5 feet
9	YELLOW BROWN WELL GRADED SAND (SW), wet, loose, mostly fine to coarse sand, cobbles (4.5 inch long), Alluvium
13.5	DARK BROWN CLAYEY SAND (SC), medium dense, mostly fine sand, some clay
15.5	BLUE-GRAY CLAYSTONE, strongly weathered
19	Total Depth = 19.0 ft.

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Log of Boring, and
Well Completion Diagram, USE-4
Denver Radium Site
Operable Unit VIII
Denver, Colorado

FIGURE
9

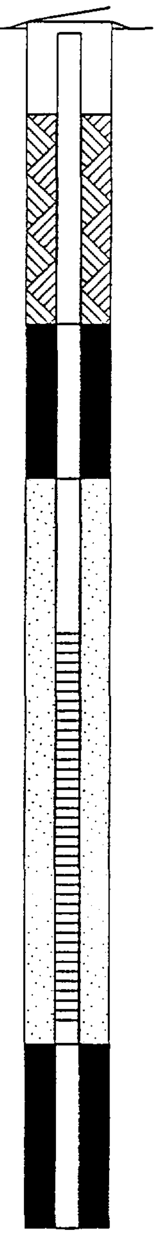
DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
LDZ	38923,3		7/1/98	

TOP OF CASING ELEVATION ________ ft.

EQUIPMENT B-59

ELEVATION ________ DATE 6/9/98

GROUND SURFACE



Top of casing 0.05 feet below ground level
8.5-in.dia. Borehole 0 to 15.5 ft.
2-in.dia. Schedule 80 PVC blank casing 0.05 to 7.8 ft.
Cement sand seal 1.1 to 3.8 ft.

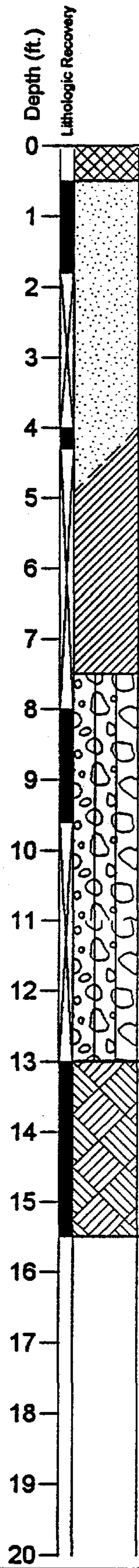
Bentonite pellet seal 3.8 to 5.8 ft.

CSSI 16-40 Sand pack 5.8 to 13.1 ft.

2-in.dia. Slotted (0.010-in.) screen 7.8 to 12.8 ft.

2-in.dia. Schedule 80 PVC blank silt trap 12.8 to 15.2 ft.
Bentonite pellet seal 13.1 to 15.5 ft.

Bottom well cap 15.5 ft.
Hole cleaned out to 15.5 ft.
Bottom of borehole 15.5 ft.



Depth (ft.)	Description
0	GRAVEL FILL, 1.5 inch diameter
0.5	YELLOW BROWN SAND (SP), wet, loose, poorly graded, mostly fine sand, trace medium to coarse sand, fill
4	CLAY (CL), moist, medium dense, few silt, slightly plastic
7.5	REDDISH BROWN SILTY GRAVEL (GM), mostly 3-4 inch cobbles, some fine to coarse sand, little silt, loose, Alluvium
11	Easier drilling after 10 feet
13	GRAYISH BROWN CLAYSTONE, dry, low hardness, friable, deeply weathered, bedrock
15.5	Total Depth = 15.5 ft.

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Log of Boring, and Well Completion Diagram, USE-5
Denver Radium Site
Operable Unit VIII
Denver, Colorado

FIGURE **10**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
LDZ	38923,3		7/1/98	

TOP OF CASING
ELEVATION ________ ft.

EQUIPMENT B-59

ELEVATION ________ *DATE* 6/9/98

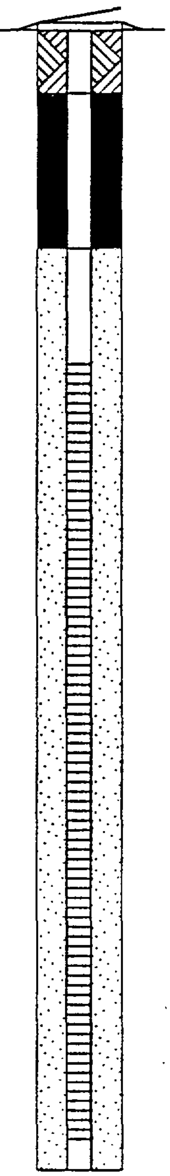
GROUND SURFACE

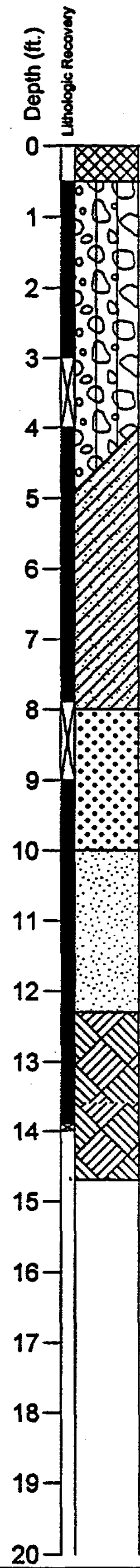
Top of casing 0.12 feet above ground level
8.5-in.dia. Borehole 0 to 14.7 ft.
2-in.dia. Schedule 80 PVC blank casing +0.12 to 4.3 ft.
Cement sand seal 0 to 0.8 ft.
Bentonite pellet seal 0.8 to 2.8 ft.

CSSI 16-40 Sand pack 2.8 to 14.7 ft.

2-in.dia. Slotted (0.010-in.) screen 4.3 to 14.3 ft.

Bottom well cap 14.7 ft.
Hole cleaned out to 14.7 ft.
Bottom of borehole 14.7 ft.





GRAVEL FILL, 1.5 inch diameter

MEDIUM BROWN SILTY GRAVEL (GM), mostly fine gravel, trace coarse gravel

BROWN CLAYEY SAND WITH GRAVEL (SC), moist, medium dense, mostly fine to medium sand, some clay, few fine to coarse subrounded gravel, firm, Alluvium

WELL GRADED SAND (SW), wet, loose, mostly fine to coarse sand, coarsening with depth

POORLY GRADED COARSE SAND (SP), few fine to coarse gravel, trace cobbles 3-4 inch diameter

GRAYISH BROWN CLAYSTONE, low hardness, friable, intensely fractured, deeply weathered bedrock
Color change at 13.6 ft. to yellow-brown

Total Depth = 14.7 feet.

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Log of Boring, and
Well Completion Diagram, APM-1
Denver Radium Site
Operable Unit VIII
Denver, Colorado

FIGURE **11**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
LDZ	38923,3		7/1/98	

CONSTRUCTION SPECIFICATIONS
Table of Contents

Section 01020
Health and Safety

Part 1 - General

1.1 Scope

A. This section describes the project health and safety requirements, equipment, and personnel decontamination requirements, and procedures which will be required to be used during Phase II. Contractors and Subcontractors may conduct activities under their own health and safety plans provided such plans are no less protective of worker health and safety than the requirements set forth in these Specifications. A designated Health and Safety Officer and the Site Supervisor shall determine the adequacy of any Contractor's or Subcontractor's health and safety plans prior to their use at the Bannock Street Site.

B. Related Work

1. Division 1 sections of these Specifications.

2. Division 2 sections of these Specifications.

Part 2 - Products

Not used.

Part 3 - Execution

3.1 Phase II - Site Safety Compliance

Project management activities associated with health and safety shall be conducted in accordance with this Specification and the Phase II Site Safety Plan (SSP). Task description and hazard evaluation details are provided in Chapter 3.0 of the Phase II - SSP.

3.2 Personnel Safety and Training

A. Personnel Safety

All necessary safeguards shall be taken to ensure the safety of workers during the remedial action (RA). These shall include, but not be limited to, the following:

1. Workers shall not be permitted underneath loads handled by lifting or digging equipment. Personnel are required to stand away from any vehicles being loaded or unloaded to avoid being struck by any spillage or falling materials.

2. Emergency rescue equipment such as a breathing apparatus, safety harness, and line shall be readily available where hazardous atmospheric conditions exist or may be reasonably expected to develop during work in excavations.

3. Any excavation that meets the definition of a confined space in 29 Code of Federal Regulations (CFR) 1910.146 shall be treated as such, and all applicable procedures detailed in Chapter 12.0 of the Phase II - SSP shall be followed.

4. All workers in an excavation shall be protected from cave-ins by an adequate protective system. Adequate barrier physical protection (shoring) or sloping shall be provided as well as all other protective measures required by 29 CFR 1926, Subpart P.

5. Inspections of excavations, the adjacent areas, and protective systems shall be made and documented by the Health and Safety Officer identifying evidence of a situation that could result in possible cave-ins, indications of failure of protective systems, hazardous atmospheres, or other conditions.

6. No worker or any other person shall enter a confined space excavation until the work area has been inspected by the Health and Safety Officer. The inspection shall determine if conditions exist which may expose workers to unsafe conditions. Any deficiencies identified during inspections shall be addressed prior to work in excavation.

7. All personnel involved in the excavation of soils exhibiting radioactivity shall be provided with an appropriate dosimeter. This dosimeter must be worn at all times when the employee is on site. The dosimeter shall be analyzed monthly. Dosimetry results shall be made available to all affected employees upon receipt.

8. The maximum speed limit for on-site work vehicles and equipment shall be 15 miles per hour.

9. Areas where excavation and S/S are performed shall be designated as restricted areas.

10. Mobile-powered equipment and mechanical mixing shall only be operated by trained and experienced personnel.

11. Mixers, conveyors, agitators, or other equipment which have moving parts shall be effectively guarded and protected in accordance with applicable Occupational Safety and Health Administration regulations.

12. Construction workers and supervisors shall be responsible for health and safety implementation during construction activities.

B. Training

All persons active in the RA on the Bannock Street Site shall receive training as specified in Chapter 4.0 of the Phase II - SSP that meets the requirements of 29 CFR 1910.

Additionally, to protect the workers involved in both the excavation and sampling operations, standard safety protocols will be required and stressed in daily "tailgate" safety meetings. These protocols include informing personnel involved with various operations as to the identity and responsibilities of the individuals assigned to the area, the use of hand signals to inform equipment operators of changing expectations or conditions on the ground, inspection/maintenance of equipment warning devices such as audible backup alarms, lights, and the use of equipment spotters (if necessary).

C. Personal Protective Equipment (PPE)

The Health and Safety Officer shall evaluate individual tasks and work areas, and specify PPE based on this evaluation. PPE utilized in the performance of the Work under these Specifications shall be in accordance with Chapter 5.0 of the Phase II - SSP.

D. Medical Surveillance

Construction personnel shall be subject to the medical surveillance requirements described in Chapter 7.0 of the Phase II - SSP.

E. Environmental Monitoring

Environmental monitoring including a dosimetry program, work area air monitoring, and personal air monitoring shall be conducted in accordance with Chapter 8.0 of the Phase II - SSP.

F. Perimeter Air Monitoring

Air monitoring stations shall be placed in such a manner that samples are collected from locations that are upwind and downwind of planned activities. Air monitoring stations shall measure air quality to alert project personnel if any potential off-site impacts occur due to activities on the Bannock Street Site.

G. Site Control

Site control for the Bannock Street Site during construction activities shall be conducted in accordance with Chapter 9.0 of the Phase II - SSP. Access control fencing shall be in accordance with Section 01500 of these Specifications.

H. Release of Construction Vehicles/Equipment for Unrestricted Use

1. Prior to being released for unrestricted use, all construction vehicles and equipment shall be frisked and decontaminated, if necessary. Contaminated vehicles and equipment shall be decontaminated using a pressurized water spray in accordance with Section 10.2 of the Phase II - SSP. Water generated during the decontamination activities shall be evaporated or used for dust control.

2. All equipment or reusable PPE will be thoroughly scanned using an alpha and beta detection device to ensure adequate cleaning prior to removal from the Bannock Street Site or reuse by site personnel. Additional cleaning may be necessary as deemed appropriate by the Health and Safety Officer. The Health and Safety Officer and Site Manager will ensure that all equipment, tools, etc., are adequately cleaned of hazardous constituents prior to removal from the Bannock Street Site. Clearance of all equipment proposed to be removed is required and the appropriate surveys will be documented.

3.3 Decontamination Procedures - Equipment Decontamination

A. On-site equipment which is potentially contaminated shall be taken to the decontamination area for decontamination utilizing a high-pressure washing device using conventional soap solutions.

B. Reusable equipment shall be scanned for alpha and beta radioactivity to ensure adequate cleaning.

3.4 Personnel Decontamination

A. Personnel decontamination procedures shall be conducted in accordance with Section 10.1 of the Phase II - SSP.

B. Project personnel shall be decontaminated and frisked prior to leaving the restricted areas on the Bannock Street Site. Personnel decontamination shall include boot washes and/or removal of boot protectors and the removal of latex gloves, Tyvek outer garments, and respirators.

C. Used PPE and water resulting from decontamination activities shall be managed in accordance with Chapter 10.0 of the Phase II - SSP.

3.5 Dust and Water Runoff Control

Dust control measures used during construction activities on the Bannock Street Site include, but are not limited to, the following:

A. Using hoses with mist or fog nozzles to spray applications of water over the areas of excavation, staging, load out, and stockpiles.

B. Minimizing travel over above-action-level soil by heavy equipment.

C. A maximum speed limit for heavy equipment of 15 miles per hour.

D. Wetting of access roads with water as necessary to control dust.

E. Cover soil stockpiles.

3.6 Traffic Control

Traffic on South Bannock Street may need to be restricted or controlled while the RA is conducted. The flow of traffic shall be controlled as necessary and in accordance with the City and County of Denver requirements.

3.7 Contingency Plans and Emergency Response Procedures

Contingency plans and emergency response procedures for the Phase II activities shall be followed. These plans and procedures shall be followed in the event of an emergency situation arising from the Work activities, accidents, or any uncontrollable event such as an Act of God that may affect the health and safety of the workers.

Section 01030
Special Project Procedures

Part 1 - General

1.1 Scope

This section describes the project requirements and procedures for inspections, construction precertification notice, and the construction completion report and the RA completion report.

1.2 Related Work

A. Division 1 sections of these Specifications.

B. Division 2 sections of these Specifications.

1.3 Submittals

A. Comply with the provisions of Section 01340 of these Specifications.

B. Prepare daily and weekly reports on construction activities. The daily reports and the weekly report shall be compiled and delivered to USEPA each week.

C. Prepare and submit monthly progress reports to the USEPA as detailed in Item 44 of the Administrative Order. Each monthly report shall be submitted on or before the 10th day of each month.

D. Submit the construction precertification notice to the USEPA as required by Section 3.2 of this Specification.

E. Submit the construction completion report to the USEPA as required by Section 3.3 of this section.

F. Submit the remedial action (RA) completion report as required by Section 3.4 of this section.

Part 2 - Products

Not used.

Part 3 - Execution

3.1 Inspections

A. Earth Sciences Consultants, Inc. (Earth Sciences)/AWS Remediation, Inc. (AWS Remediation) shall review all construction activities to verify that all Work is in compliance with these Specifications and shall note and resolve all discrepancies promptly.

B. After submittal of the construction precertification notice, USEPA shall conduct a construction precertification inspection consisting of a walk-through of the site. USEPA and its authorized representatives shall inspect the Work to determine whether the construction is complete and consistent with the ROD, Unilateral Administrative Order (AO), and these Specifications.

3.2 Construction Precertification Notice

Notify USEPA within 30 days after concluding that construction has been fully performed in accordance with the ROD, AO, and these Specifications.

3.3 Construction Completion Report

Within 30 days after the construction precertification inspection, Shattuck shall submit a construction completion report to USEPA. This report shall include the following:

A. A narrative description of the Work performed including any modifications approved by USEPA and verification that this Work was performed.

B. As-built drawings showing the final Phase II construction details.

C. Final specifications.

D. A list and narrative description of project change orders, nonconformance reports, and the corrective actions taken for those nonconformance reports.

E. The actual construction schedule.

F. Quality assurance/quality control (QA/QC) reports.

G. Construction precertification inspection report(s) by USEPA and the corrective actions taken to address any deficiencies.

H. All signed construction element completion forms.

I. A certification by Shattuck that the Work was completed in accordance with all requirements of the ROD, AO, and the approved work plan.

J. A certification by both the Certifying Engineer and a Registered Professional Engineer licensed to practice in the State of Colorado that the construction is complete.

3.4 RA Completion Report

Within 90 days after Shattuck concludes that the RA has been performed and performance standards have been obtained, Shattuck shall submit the RA completion report. The report shall include the following:

A. A narrative description of the Work performed including any modifications approved by USEPA and verification that this Work was performed.

B. A list and narrative description of project change orders, nonconformance reports, and the corrective actions taken for those nonconformance reports.

C. Groundwater monitoring results.

D. QA/QC reports.

E. A certification by Shattuck that the Work was completed in accordance with all requirements of the ROD, AO, and the approved work plan.

F. A certification by both the Certifying Engineer and a Registered Professional Engineer licensed to practice in the State of Colorado that the construction is complete.

Section 01050
Field Engineering

Part 1 - General

1.1 Scope

This section describes the field engineering activities necessary for proper completion of the project including, but not limited to, establishing and maintaining lines and grades, design of shoring and bracing, and similar items necessary to perform the Work.

1.2 Related Work

A. Division 1 sections of these Specifications.

B. Division 2 sections of these Specifications.

Part 2 - Products

Not used.

Part 3 - Execution

3.1 Field Measurements and Templates

Field measurements necessary to perform the Work included in these Specifications shall be obtained. Templates, patterns, and setting instructions needed to perform the Work shall be obtained.

3.2 Establishing and Maintaining Lines and Grades

A. Surveying required for layout and control of the project shall be performed by a Surveyor licensed to practice in the State of Colorado.

B. A permanent grid system shall be established along the perimeter of the Bannock Street Site that will be utilized to lay out the interior on-site grid during construction. Perimeter grid points shall be established every 30 feet utilizing 4-feet-by-1/2-inch lath indicating northing and easting.

C. Internal grid points shall be set using wooden stakes every 30 feet in the north/south and east/west locations where they will not interfere with site activities, and initial elevations will be established for these points.

3.3 Design of Shoring and Braces

Design of shoring, bracing, and slope stability to be used on the project shall comply with 29 CFR 1926, Subpart P. All shoring and bracing designs shall bear the seal and signature of a Professional Engineer licensed to practice in the State of Colorado.

Section 01340
Project Submittals

Part 1 - General

1.1 Scope

This section describes key submittals required by these Specifications. Additional submittals not included in this section may be necessary to establish compliance and approval by the U.S. Environmental Protection Agency (USEPA). Other submittal requirements are noted in appropriate project documents (i.e., Site Safety Plan, Quality Assurance Project Plan, Administrative Order, etc.).

1.2 Related Work

Requirements for specific submittals are described in pertinent sections of these Specifications.

Part 2 - Products

Not used.

Part 3 - Execution

3.1 Identification of Submittals

3.2 Timing of Submittals

Submittals shall be submitted far enough in advance of scheduled dates for performance of the Work to provide time for review, approval, possible revision and resubmittal, and for placing orders and securing delivery.

3.3 Summary of Routine Submittal Requirements to USEPA and Colorado Department of Public Health and Environment (CDPHE).

The following documents which are discussed in detail in the specification sections referenced in the following table shall be submitted to the USEPA and CDPHE:

Submittal	Reference Section No.	Reference Article No.	Number of Copies Required	Submittal Requirement
Notification of Commencement of Work Activities	01420	1.3.B	2	Prior to commencement of work activities.
Daily Construction Reports	01030	1.3	2	Weekly.
Weekly Construction Reports	01030	1.3	2	Weekly.

Submittal	Reference Section No.	Article No.	Number of Copies Required	Submittal Requirement
Monthly Progress Reports	01030	1.3	2	On or before the 10th of each month.
Construction Precertification Notice	01030	1.3.B	2	Within 30 days after Shattuck concludes project has been completed.
Construction Completion Report	01030	1.3.C	2	Within 30 days after the construction precertification inspection.
RA Completion Report	01030	1.3.D	1	Within 90 days after Shattuck concludes RA has been completed.

3.4 Summary of Submittal Requirements to QA Manager

Submittal	Reference Section No.	Article No.	Number of Copies Required	Submittal Requirement
Riprap Certification	02275	2.1	3	15 days prior to placement.
Geosynthetic Clay Liner (GCL) manufacturer's QA/QC certifications	02778	1.3	3	15 days prior to delivery to the site.
Certificates of subgrade acceptance for placement of GCL	02778	1.3	3	Prior to Placement of GCL.
Type I/II Portland Cement Certification	02210	3.3.1.1		15 days prior to delivery to the site.
Type C Fly Ash Certification	02210	3.3.1.2		15 days prior to delivery to the site.
Class C Sand Certification	02774	1.3		15 days prior to delivery to the site.
Class A Gravel Certification	02774	1.3		15 days prior to delivery to the site.
Vendor Labs Internal Management Procedures for Data Reduction	01410	1.3		Prior to testing.

Section 01410
Testing Laboratory Services

Part 1 - General

1.1 Scope

This section describes the testing laboratory services required for this project.

1.2 Related Work

A. Division 1 sections of these Specifications.

B. Division 2 sections of these Specifications.

1.3 Submittals

A. Vendor laboratory internal management procedures for data reduction shall be submitted to the QA Manager as described in Section 9.1.2 of the Quality Assurance Project Plan (QAPP).

B. Vendor laboratory data validation packages shall be submitted to the QA Manager upon request as described in Section 9.2.2 of the QAPP.

Part 2 - Products

Not used.

Part 3 - Execution

3.1 Testing Laboratory Analytical Methods and QA/QC

Testing laboratories used on this project shall meet or provide the following:

A. Analytical methods and/or ASTM standards approved by the USEPA. All protocols for any analytical methods to be used for this project shall meet the requirements of these Specifications. No variations or changes from approved testing procedures shall occur unless such variations or changes are requested in writing and approved in writing by the Project Manager. USEPA approval must be obtained by the Project Manager and provided to the testing laboratory prior to using a variation or change of test procedures.

B. A documented QA/QC Program that complies with USEPA Guidance Document QAMS-005/80 or an approved equivalent.

3.2 Analysis of USEPA QA/QC Samples

Upon USEPA request, any laboratory or laboratories used on this project shall analyze samples submitted by the USEPA for QA/QC monitoring at no cost to the USEPA.

Section 01420
Sampling and Analyses

Part 1 - General

1.1 Scope

This section details the sampling and analysis for the Phase II Remedial Action. Sampling and analysis activities are associated with, but not limited to, the following: excavation, fill material, monolith foundation preparation, preprocessing materials, preplacement materials, cover system components, and air monitoring.

1.2 Related Work

A. Division 1 of these Specifications.

B. Division 2 of these Specifications.

1.3 Submittals

A. Comply with pertinent provisions of Section 01340 of these Specifications.

B. USEPA shall be notified prior to commencement of Work under this Specification. The USEPA shall be notified in writing not less than 14 days prior to any activity which may involve or require sampling. At the request of the USEPA, split or duplicate samples may be taken by USEPA or its authorized representatives of any samples collected with regard to Phase II construction activities.

Part 2 - Products

Not used.

Part 3 - Execution

3.1 Excavation Control, Verification, and Confirmation

A. General Procedures

1. Sampling for excavation control, verification, and confirmation shall be conducted in accordance with the procedures described in Chapter 3.0 of the Field Assessments Procedures Manual (FAPM) prepared for the U.S. Department of Energy, Uranium Mill Tailing Remedial Action Project (UMTRA) with the following exceptions:

a. When the performance criteria set forth in Section 3.3 of the FAPM conflict with the performance criteria set forth in Table 9-2 of the ROD, the criteria set forth in the ROD shall be used for excavation control.

b. During the Phase II excavation activities on the Bannock Street Site, the confirmation samples shall be analyzed by Paragon Laboratory (formerly Analytical Technologies, Inc.) of Fort Collins, Colorado rather than Geotech Analytical Laboratory as set forth in Section 3.7.2 of the FAPM.

c. The Ludlum Model 4410 Low-Level Gamma Scintillation Detector with a Ludlum Model 2221 Scalar/Rate Meter Single-Channel Analyzer (Ludlum scintillometer) shall be used to conduct gamma surveys during the excavation activities. A lead shield shall be used with the Ludlum scintillometer to reduce the effects of gamma shine.

2. Thirty-foot-by-30-foot grids shall be established for areas to be excavated. Grids shall be further divided, when verification samples are to be taken, into 10-foot-by-10-foot blocks. Blocks shall be logically identified by their location within the grid.

B. Excavation Control Survey

1. A shielded gamma scintillometer will be used during above-action-level excavation to determine the level of gamma radiation within a grid. The high, low, and average (most commonly observed) gamma readings shall be measured at the excavated ground surface and recorded. Readings shall be taken at locations and frequency specified by the supervising QA personnel.

2. A grab sample shall be taken and analyzed by Opposed Crystal System Gamma Radiation Counter (OCS) during the excavation to determine the Radium-226 concentration at particular locations within a grid. Sampling shall be performed at locations and frequency specified by the supervising QA personnel and the analysis shall be performed on site.

3. Further excavation for the grid shall be required if excavation control analyses indicate above-action-level soil remains. If above-action-level soil has been removed, verification shall begin.

C. Verification Survey

1. A shielded gamma scintillometer shall be used to determine the level of gamma radiation within a grid. The high, low, and average (most commonly observed) gamma readings shall be measured at the excavated ground surface and recorded. Locations and frequency of measurements will be specified by the QA Manager.

2. A composite sample shall be obtained by combining aliquot samples from the center and corner blocks of the grid and shall be analyzed by OCS to determine the Radium-226 concentration for the grid. The analysis shall be performed on site.

3. Further above-action-level excavation for the grid shall be required if verification analyses indicate above-action-level soil remains. If above-action-level soil removal is verified, confirmation shall begin.

D. Confirmation Survey

1. Up to ten verification samples shall be composited to form a confirmation sample which shall be analyzed by Paragon Laboratory for:

   a. Radium-226;
   b. Natural Uranium;
   c. Total Arsenic, Selenium, and Lead (Analytical Method 6010);
   d. Toxicity Characteristic Leaching Procedure (TCLP) for Arsenic, Selenium, and Lead (USEPA Document SW-846 methods)).

   If results indicate that the composite soil sample exceeds Resource Conservation and Recovery Act limits for hazardous waste determination, additional sampling and analysis will be performed in order to precisely locate the area(s) of the exceedance within the composite area. When the area(s) are identified, further excavation will be performed to remove the affected soil. Excavation will continue, if necessary, into the saturated zone.

2. The first 20 verification samples collected at the site shall be analyzed by Paragon Laboratory for Thorium-230. If analysis results indicate that Thorium-230 is above the action level in Section 3.1.A, additional analyses will be performed on other verification samples. If all analytical results of the first 20 samples indicate no concern for Thorium-230 contamination, then the confirmation sampling protocol stated in Section 3.1.D.1 shall be followed for Thorium-230.

3. Confirmatory testing will be completed prior to preparation of the monolith foundation and placement of S/S materials. This will be facilitated, if necessary, by expediting laboratory analyses of confirmatory samples. No S/S materials placement will occur in excavated areas which have not been confirmed through laboratory analyses that all above-action-level soils have been removed.

4. If above-action-level soil removal is confirmed then below-action-level excavation may begin.

3.2 Fill Material

A. A Modified Proctor (ASTM D 1557) and an in-place density (sand cone) (ASTM D 1556) shall be performed once per 1,000 cubic yards or as soil characteristics change in order to ensure a compaction of at least 90 percent maximum dry density at plus or minus 2 percent of optimum moisture content. All samples required for Modified Proctor testing will be taken by the Construction Inspector or his designated representative.

B. Imported fill material samples will be obtained by the Construction Inspector or his designated representative for each fill specification from each supplier or as materials change. This sample will be tested as indicated in 3.1.D.1 (a, b, c, and d) with the addition of testing for thorium-230.

C. Imported fill material will be tested for gamma radiation using a shielded gamma scintillator and sampled and checked by OCS for radium-226 on site prior to acceptance. The required frequency of testing is one for each 500 cubic yards of placed soil or as source or material changes.

3.3 Monolith Foundation Preparation

A Modified Proctor (ASTM D 1557) and an in-place density (sand cone) (ASTM D 1556) shall be performed once every 20,000 square feet of monolith foundation or as soil characteristics change in order to ensure a compaction of at least 90 percent maximum dry density at plus or minus 2 percent of optimum moisture content.

3.4 Preprocessing Materials

A. Raw Materials

1. Water to be used in the S/S processing will be analyzed once prior to start-up of the S/S Processing Unit or as the supplier or source changes for compliance with ASTM C 94.

2. Cement will be certified by the supplier to be Type I/II portland cement.

3. Fly ash will be certified by the supplier to meet Type C Fly Ash requirements.

B. Feedstock Material

1. The following tests shall be performed once per 2,500 cubic yards or at least once per completed feedstock stockpile on samples from the prepared feedstock stockpile:

   a. Particle-size distribution (ASTM D 422).
   b. Atterberg limits (ASTM D 4318).
   c. Standard Test Method for Moisture Density Relations of Soil Cement Mixtures (ASTM D 558 with ASTM D 1557 compaction energy).
   d. OCS for Radium-226.

2. Moisture content (ASTM D 4643) analysis for the feedstock stockpile shall be performed at the start of each processing day for mill calibration.

3. The Moisture Density analysis shall require mixing a feedstock stockpile sample with cement and fly ash in the appropriate percentages (70:20:10). Water content will be varied slightly to achieve a curve which will be used to obtain a target preplacement and in-place monolith density.

3.5 Preplacement Materials

A. Preplacement materials shall be tested once per 500 cubic yards or twice per working day of S/S processing for the first 5 days for:

   1. One Point Compaction (ASTM D 558 with ASTM D 1557 energy); and
   2. Unconfined Compressive Strength (ASTM D 1633).

   Frequency changes to 1/1,000 cy or minimum of 2 per day after first 5 days.

   The target density is at least 90 percent maximum dry density, 4 to 6 percent over optimum moisture content based on the feedstock testing performed under 3.4.B.1.c. developed for the feedstock in use at the time.

B. Chemical testing of preplacement materials will require preparation of test cylinders using ASTM D 1557 energy, leachate extraction (ASTM D 3987), and analyses for the following:

   a. Radium-226.
   b. Natural Uranium.
   c. Thorium-230.
   d. Arsenic, Lead, and Selenium (Analytical Method 6010).

   The required frequency of sampling is 1 sample per 10 days of S/S processing.

C. Contingency evaluation measures will be followed in the event that in-place treated material fails either the physical or chemical analysis. The initial step will be to verify the analytical procedures and protocol. Reanalysis of the leachate extract sample for the chemical test will be performed if possible. If the cause of the problem is not identified, another chemical leaching extraction and analysis of the preplacement material will be performed.

   Evaluation of the placement location of the suspect materials in the monolith will then be considered to determine if additional contingency measures are necessary. If this evaluation indicates that the materials are not acceptable, then an estimate based on placement records will be made as to the extent of S/S material that is questionable. This material will be broken out of the monolith with a hoe-ram or a similar piece of equipment, collected and reprocessed.

3.6 Placed and Compacted Materials

The in-place monolith will be tested for in-place density (sand cone) (ASTM D 1556) once per 500 cubic yards or twice per working day of S/S processing to verify a target density of 90 percent maximum dry density, 4 to 6 percent over optimum moisture content based on the density testing indicated in 3.4.B.1.C for the feedstock stockpile in use at the time.

3.7 Cover System Components

Sampling and analysis will be completed as detailed in Sections 02271, 02275, 02774, and 02778 of these Specifications.

3.8 Covered Monolith Survey

A. Within 30 days after completion of the monolith cover system, the monolith will be surveyed for gamma radiation using an unshielded low-level scintillation detector. To accomplish the required testing, 1-square-meter grids will be established and each grid will be subdivided into 9 blocks. The required measurements will be taken within the center block at the cover surface and at an elevation 1 meter above the cover surface.

B. Within 30 days after completion of the monolith cover system, the monolith will be surveyed for radon flux using a charcoal canister. This testing will be done at the cover surface at a frequency of 1 per 20,000 square feet of cover.

C. Within 30 days after completion of the monolith cover system, the monolith will be tested for radon concentration using a charcoal canister at the site property line. This testing will occur at a frequency of 1 per 100 linear feet of property line.

3.9 Air Monitoring

A. Perimeter air monitoring shall be conducted in accordance with Section 2.1 of the Phase II - Sampling and Analysis Plan (SAP).

1. Air monitoring stations shall be established along the perimeter of the Bannock Street Site to measure air quality and alert project personnel to any potential off-site impacts that may occur from Phase II construction activities. In the event that air monitoring activities indicate that the potential of off-site impacts may be occurring, all construction activities shall cease until dust control activities can be enacted and air monitoring indicates that the potential off-site impact has been eliminated.

2. Air monitoring stations shall be placed in such a manner that samples that are upwind and downwind of planned activities.

3. All airborne samples shall be collected in accordance with Section 2.1 of the Phase II - SAP.

4. Air samples shall be analyzed for total suspended particulates (TSP), PM_{10}, lead, arsenic, selenium, and radioactivity.

5. Prior to construction activities, background samples shall be collected for a period of 30 days. All background samples shall be analyzed for TSP and PM_{10}.

6. Separated background samples from each perimeter sampling location shall be obtained for measurement of total radioactivity. Background samples shall be analyzed for lead, selenium, and arsenic.

7. Chapter 6.0 of the Phase II - SAP details the specifics of the analytical program.

B. Personal air samples.

1. Personal air samples shall be obtained from personnel who may be potentially exposed to respiratory hazards during Phase II construction activities.

2. Samples shall be collected in accordance with Section 2.2, Personal Air Samples, from the Phase II - SAP.

3. Personal air samples shall be analyzed for those respiratory hazards identified by the Site Safety Officer.

4. The crew member having the greatest potential exposure to radioactivity for each workday shall have his breathing zone sampled using a dust filter cassette and personal sampling pump. Total airborne dust shall be sampled for total dust, gross alpha, and gross beta radioactivity.

C. Work place area monitoring.

1. In areas identified as potentially radioactive, area monitoring shall be conducted to evaluate the presence of radionuclides.

2. After determining the amount of radioactivity in the material collected, additional analysis may be performed for lead (or other metals) if experience with the characteristics of the site soils indicates the constituents may pose a potential concern.

3.10 Sample Collection Procedure

All samples shall be collected using standard equipment and procedures as described in the Final Phase II - SAP and as described in these Specifications.

3.11 Sample Management

A. Earth Sciences/AWS Remediation shall maintain a documented chain of custody record for all samples submitted for analysis by an off-site laboratory in accordance with the Phase II - QAPP.

B. Earth Sciences/AWS Remediation shall use sample containers for the collection of soil samples in accordance with the Phase II - QAPP.

C. Earth Sciences/AWS Remediation shall use sample shipment procedures in accordance with the Phase II - QAPP.

3.12 Additional Testing

In the event that additional sampling is desired, USEPA shall be notified in accordance with the AO prior to such sampling.

Section 01500
Temporary Facilities

Part 1 - General

1.1 Scope

This section describes the Work required to provide, maintain, and remove at the completion of the project all temporary facilities and controls needed for the project including, but not limited to, the following:

A. Temporary utilities including water, electricity, and heating as necessary.

B. Supporting facilities including sanitary, trash disposal, and cleanup facilities.

C. Temporary protection facilities including access control fencing and weather protection.

1.2 Related Work

A. Division 1 sections of these Specifications.

B. Division 2 sections of these Specifications.

Part 2 - Products

Not used.

Part 3 - Execution

3.1 Utilities

A. Water

1. A temporary water supply shall be provided for dust and moisture control during excavation and backfill operations, for personnel decontamination, S/S process water, and for other requirements.

2. Potable water dispensers or similar facilities shall be provided for personnel use during Remedial Action.

B. Electricity

Temporary electrical services such as portable generators for construction purposes and related activities shall be provided.

C. Heating

Portable heaters shall be provided as necessary for worker safety and to protect construction work from damage during periods of cold weather.

3.2 Supporting Facilities

A. Sanitary Facilities

Sanitary facilities shall be provided for use by all on-site personnel.

B. Trash Disposal and Property Cleanup

Containers shall be provided for disposal of uncontaminated construction debris and trash. At reasonable intervals and not less than once per week, trash and debris accumulated in the containers shall be removed and disposed at a permitted landfill.

3.3 Temporary Access Control and Weather Protection Facilities

A. Access Control Fencing

1. Prior to starting construction activities, access control fencing shall be erected as necessary to prevent access to restricted areas. Sufficient area within the boundary of the access control fencing shall be provided to contain the work area and allow safe operation of equipment.

2. Access control fencing shall be, at a minimum, chain-link fencing with a 6-foot height. Stabilized anchor post bases shall be used for the fencing.

3. Warning signs on access control fencing shall be installed at appropriate intervals. Warning signs shall be placed prior to initiating construction activities and removed at the completion of the project.

B. Weather Protection

Temporary enclosures shall be installed as needed to protect construction from damage due to weather, or to maintain suitable temperatures during the performance of the Work. At the end of each day's work, all Work susceptible to weather damage shall be protected.

Section 02200
Earthwork

Part 1 - General

1.1 Scope

This section describes the earthwork requirements for excavation, stockpiling, backfilling, compaction, and final grading.

1.2 Related Work

A. Division 1 sections of these Specifications.

B. Division 2 sections of these Specifications.

Part 2 - Products

2.1 Fill Materials

A. Below-Action-Level Soil - Soils with concentrations of constituents of concern below those specified in Table 9-2 of the ROD, except as modified by the USEPA letter to the CDH dated January 16, 1992 which modified the generic protocol for excavation of Thorium-230.

B. Common Fill - Imported clean fill suitable for use where indicated in the plans and specifications from an approved off-site location.

2.2 Additional Requirements for Imported Fill

All imported fill materials shall meet the requirements of below-action-level soils as defined in Section 01010 of these Specifications.

Part 3 - Execution

3.1 General

A. Work performed shall be constructed to the lines, grades, elevations, slopes, and cross sections indicated on the Drawings, specified herein, and/or directed by the Construction Inspector. Slopes, graded surfaces, and drainage features shall present a neat and uniform appearance upon completion of the Work.

B. Measures shall be taken as necessary to protect the site from storm damage, flood hazard, caving of trenches and embankments, and sloughing of material.

3.2 Clearing

A. Objectionable materials and obstructions encountered above and below the ground surface including brush, grass, vegetative matter, and other objectionable materials within the area of excavation shall be removed. Brush and organic material shall be removed before placing any backfill.

B. Debris and Surplus Material - Materials resulting from clearing shall be removed and properly managed.

3.3 Dust Control

A. Dust control measures to be used during excavation activities on the Bannock Street Site shall include, but are not limited to, wetting with hoses equipped with mist or fog nozzles to spray light applications of water over areas of excavation, staging, load out, and stockpiling.

B. Dust minimization procedures shall include, but not be limited to, the following:

1. Equipment shall not be driven at speeds in excess of 15 miles per hour.

2. Areas which shall be traveled extensively by equipment shall be wetted as necessary to control dust and will be located away from the site perimeter to the extent practicable.

3. Soil stockpiles shall be covered as discussed in Section 02280 of these Specifications.

3.4 Surface Water Management

A. Surface water shall be managed by utilizing berms and drainage channels at the site perimeter and in areas where above-action-level soil is stockpiled and processed to prevent surface water from leaving the site or impacting site operations.

B. Prior to placement of the monolith cover system, storm water run on will be prevented in areas of monolith placement by grading the 20-foot perimeter zone to slope away from the monolith.

C. Surface water control measures used on the Bannock Street Site shall include, but are not limited to, the following:

1. Excavation of temporary swales and ditches.

2. Construction of temporary diversion dikes and berms.

3. Construction of a temporary storm water retention basin.

3.5 Haul Roads

A. Haul roads at grade will be constructed using a 20-mil (minimum) HDPE liner covered with 10 oz/sy nonwoven geotextile, overlain by 6 inches of Class A gravel. See Section 02774 of these Specifications for Class A gravel certification requirements.

B. If temporary equipment transportation routes over the monolith or previously treated areas are necessary, these transportation routes will consist of a minimum of 6 inches of below-action-level material compacted and maintained on a 10 oz/sy nonwoven geotextile overlying a 20-mil (minimum) HDPE liner.

3.6 Excavation

A. Excavated soils shall be placed a sufficient distance from the edge of the excavation to avoid cave-ins or bank slides. Excavated soils shall not be placed within 3 feet of the edge of an excavation.

B. Pumping, ditching, and other measures for the removal and/or transport of surface water from the active excavation area shall be performed as necessary to minimize impact on the Work.

C. Sump collection points and/or cutoffs shall be used to collect groundwater from the active excavation area as necessary to minimize impact on the Work. Collected groundwater shall be evaporated.

D. Excavation Procedures

1. Soils with concentrations above the Radium-226, Thorium-230 (as modified by USEPA), natural uranium, arsenic, selenium, and lead action levels set forth in Table 9-2 of the ROD shall be removed.

2. Control, verification, and confirmation sampling to confirm the limits of above-action-level excavation shall be performed. See Section 01420 of these specifications.

3. Noncrushable materials encountered during excavation which may include such things as wooden construction materials, pipes and other utilities, and concrete reinforcing steel will be stockpiled on site and decontaminated if necessary to remove adhering above-action-level soils or other objectionable substances. Wood, metal, asphalt, and other similar materials which are determined to be suitable for off-site disposal as solid waste will be surveyed and loaded into containers for disposal at Conservation Services, Incorporated. In the event that noncrushable materials require laboratory analysis, Earth Sciences personnel will obtain a representative sample of the material which will then be packaged and submitted for transportation to an approved laboratory for analysis of chemical and/or radiological characteristics.

Regulatory agency representatives will be informed of any noncrushable material discovered during excavation. Such materials will be subjected to chemical and/or radiological testing as approved under existing work plans or correspondence. For any noncrushable materials that cannot be addressed under existing work plans or correspondence, specific sampling and analysis procedures will be developed and submitted. In the event that on-site survey activities or laboratory analysis determines that specific items or substances are not suitable for disposal as solid waste, these materials will be packaged and managed for disposal off-site as appropriate.

4. Excavation shall be performed with a maximum slope of 2 horizontal to 1 vertical.

5. Above-action-level soil that may extend beyond the property line shall be excavated and processed by S/S. Authorized access shall be obtained prior to performing any Work on adjacent properties.

6. Below-action-level soil shall be excavated to the elevation of the base of the monolith foundation and stockpiled separately. No below-action-level soil shall be excavated until confirmation test results indicate that all above-action-level soil in the vicinity has been removed.

7. In the event significant concentrations of organics are detected during the excavation as a result of the environmental monitoring required in Section 8.0 of the Phase II - Site Safety Plan, "these materials will be segregated ...",and an evaluation of the feasibility of treating and incorporating these soils into the monolith will be completed. If necessary, a bench-scale treatability study will be completed to evaluate treating the impacted soils and incorporating these soils into the monolith.

8. Above-action-level soil shall be segregated from below-action-level soil to minimize the volume of soil requiring S/S.

9. The depression resulting from excavation below the monolith base elevation shall be backfilled with Class A gravel at elevations below the maximum recorded groundwater elevation. At elevations above groundwater, backfill will be completed to the monolith base elevation using below-action-level soil.

10. Above-action-level and below-action-level soil shall be separated during excavation and kept separate during loading, transport, and stockpiling to eliminate the potential for cross contamination.

11. Excavations shall be radiologically surveyed in accordance with Section 01420 of these Specifications to determine if additional material(s) must be removed.

3.7 Monolith Foundation Preparation

A. Any excavation below the base elevation of the monolith shall be backfilled with material compacted to 90 percent of the Modified Proctor (ASTM D 1557).

B. The monolith foundation shall be proofrolled with construction equipment to stabilize any soft areas and compact the surface material to 90 percent of the Modified Proctor (ASTM D 1557).

3.8 Fill Placement

A. All vegetable matter and objectionable material shall be removed from the surface upon which the fill is to be placed. Any loose soil shall be removed or compacted to a depth specified by the Construction Inspector. The surface shall then be plowed or scarified until the surface is free from uneven features that would prevent uniform compaction.

B. Where fills are constructed on slopes, the slope of the original ground on which the fill is to be placed shall be stepped or keyed.

C. Fill shall not be placed on frozen ground unless the ground can be scarified, recompacted, or otherwise prepared to remove the frost.

D. Fill shall be placed to the line, elevation, and grade required by the project Drawings.

E. Salvaged excavation materials shall be used for backfilling unless determined unsuitable by the Construction Inspector.

F. Fill shall be placed in thin, even, and continuous layers. Each layer shall be spread evenly and thoroughly mixed during the spreading to obtain uniformity of material in each layer. The loose thickness of each layer shall not exceed 9 inches.

G. Uniform moisture distribution shall be obtained by discing, blading, or other methods approved by the Construction Inspector prior to compaction of a layer of fill.

1. If the moisture content of the fill material is below the percent specified, water shall be added until the specified moisture content is achieved.

2. If the moisture content of the fill material is above the percent specified, the fill material shall be aerated by blading, mixing, or other satisfactory methods until the specified moisture content is achieved. If the specified moisture content is not achieved, the fill material shall be removed.

3. If the surface of any layer is too dry or smooth to bond properly with the layer of material to be placed thereon, it shall be scarified and moistened to the proper moisture content prior to placing the next layer.

H. Below-action-level soil excavated on site may be used as fill where indicated on the drawings.

3.9 Compaction

A. After each layer of fill material has been placed, mixed, and spread evenly, it shall be thoroughly compacted to achieve the required density as described in Section 01420 , Part 3.2.A.

B. Compaction shall be accomplished by sheepsfoot rollers, vibratory rollers, multiple-wheel pneumatic-tired rollers, or other types of acceptable compacting equipment.

C. Compaction shall be continuous over the entire area. Compaction equipment shall make sufficient passes over the material to ensure that the desired density has been obtained over the entire area.

D. Fill slope surfaces shall be compacted so that the slopes are stable. Excessive loose soil on slope surfaces shall not be allowed.

Section 02210
Stabilization/Solidification

Part 1 - General

1.1 Scope

This section describes the processing operations and equipment requirements for S/S of above-action-level soil and crushed rubble.

1.2 Related Work

A. Division 1 of these Specifications.

B. Division 2 of these Specifications.

1.3 Submittals

A. Supplier certification of Type I/II Cement.

B. Supplier certification of Type C Fly Ash.

C. Comply with the provisions of Section 01340 of these Specifications.

Part 2 - Products and Equipment

2.1 Products

A. Process Water - potable water that meets the requirements of ASTM C 94.

B. Cement - Type I/II as determined by ASTM C 150.

C. Fly Ash - Noncombustible fine particulate refuse from an approved supplier that meets the requirements of ASTM C 618 for Class C Fly Ash.

2.2 S/S Processing Equipment

A. The S/S processing unit shall be the Excel Port-A-Pug or approved equivalent. The processing unit shall be a mobile continuous-mixing plant capable of processing soil, cement, fly ash, and water at a rate of 280 cubic yards per hour. The unit shall be equipped with a positive adjustable governor for continuous mixing. Separate bins, silos, or tanks shall be provided and used to store process water, cement, and fly ash.

B. A vibratory screen system shall be utilized to break apart and/or remove material greater than 3 inches in size and feed the screened material into the mixing unit.

C. A universal jaw crusher with feed hopper, discharge conveyor, stacking conveyor, stationary magnet, and diesel generator core shall be used to produce crushed rubble aggregate equal to or less than 2 inches in maximum dimension.

Part 3 - Execution

3.1 S/S Processing Unit Start Up/Calibration

A. The S/S processing unit shall be calibrated by cycling a sufficient volume of soils, rubble, cement, and fly ash through the system to test the equipment for proper function, operation, and calibration. Work shall be performed to achieve a generally uniform mixture of soil and crushed rubble. At start up, a minimum of 50 cubic yards of S/S mixture shall be generated to verify calibration of the mixing system. S/S mixture generated during calibration of the pilot plant shall be placed with the crushed rubble stockpile for reprocessing.

1. Volumetric feed calibrations shall be conducted by weighing samples of the S/S mixture leaving the mixing unit and correlating the weight to the volumetric meter readings on the S/S processing unit.

2. Prior to start up of the S/S processing unit, the unit weights of the feed material, cement, and fly ash shall be determined by placing each material in a 5-gallon bucket and recording the weight of each. Recorded unit weights represent the density of the materials as placed in the storage silos/bins.

3. Volumetric feed accuracy shall be checked by collecting all material delivered during a unit of time to the mixer and by washout tests of material exiting the mixer.

   a. Washout tests shall consist of collection of all S/S mixture supplied to the exit conveyor over a predetermined period of time and verification that it equals the metered volume recorded on the mixer by converting volume to weight. The weight of material corresponding to a standard time interval and the resulting proportions of materials per cubic yard shall be determined.

   b. Volumetric feed accuracy shall be determined at least twice during calibration of the S/S processing unit prior to S/S mixture placement. The tolerance for metered materials shall be within 1 percent of the metered value. If the tolerance of 1 percent of the metered value is not achieved, the S/S processing unit shall be recalibrated.

4. Accuracy of the water volume supplied to the mixer shall be verified by measuring the water supplied to the unit over a specified time period. The accuracy of the water feed shall be determined at least twice during calibration of the processing unit prior to S/S mixture placement. Water feed accuracy shall be determined by collection of all water delivered during a unit time.

5. All safety features of the mixing unit shall be tested during the calibration process to verify proper operation. In the event that any safety features are inoperable, the unit shall be shut down until the required repairs have been made. Verification of the repairs shall be made by the Construction Inspector.

B. Calibration checks shall be performed on all S/S processing unit measuring components and verified by the Construction Inspector prior to any S/S processing and during the construction as necessary to verify that the proper design mixture is achieved. The Construction Inspector shall have access at all times to all parts of the S/S processing unit for observation of operation or verification of weights and/or proportions.

1. Calibration checks shall be made at the request of the Construction Inspector or whenever there are variations in the properties of S/S mixture that could result from volumetric feed errors. At a minimum, volumetric feed checks shall be made at the start of each working day during which processing will occur.

2. Whenever the volumetric feed is found to not comply with specification requirements, the S/S processing unit will not be operated until necessary adjustments or repairs have been made.

C. After the S/S processing unit has been calibrated, start-up operations after each mixer shutdown shall consist of activating the mixer and feed belts, opening the feed material bins, activating the cement and fly ash auger feed, and then opening and adjusting the water valve to the appropriate setting. All material produced from the beginning of start up until the mixture is visually consistent in texture shall be discarded. If a uniform mix of the required proportions is not discharged from the mixer at that time, the material shall continue to be processed and discarded until consistent material of the specified proportions is discharged.

D. The mixer shall be maintained in a satisfactory operating condition and free of hardened S/S mixture. Mixer blades shall be replaced when worn down more than 10 percent of their depth. If a uniform mixture is not being produced, the S/S processing unit shall be shut down until the mixer is repaired. The Construction Inspector shall be provided access to the mixer for obtaining representative samples of S/S mixture for testing.

3.2 S/S Processing Unit Operation

A. The S/S processing unit shall be operated within the operational parameters established by the manufacturer. The operator shall conduct routine maintenance of the processing unit, verify calibration of the processing unit and its safety features, and maintain records of the processing unit's operation during production.

B. During S/S processing unit operation, the measurement of all constituent materials including cement, fly ash, feed material, and water shall be volumetrically controlled to ensure consistent proportions.

C. Water shall be metered to develop the percentages that compensate for free moisture in the feed material and climatic conditions at the time of S/S processing and placement. The water controls shall be capable of being adjusted during the mixing process to compensate for varying moisture content in the materials being mixed.

D. S/S processing unit operation shall be performed in a manner that allows ongoing evaluation of the unit performance. S/S-processed materials shall be visually observed to determine whether the material leaving the mixing unit has been thoroughly prepared. S/S-processed materials shall not be placed until performance of the unit has been verified.

E. S/S-processed mixture shall have a soil to cement to fly ash target ratio of 70 to 20 to 10 by dry weight.

F. S/S-processed material shall be placed when the target moisture content is 4 to 6 percent over optimum. The target water to cement ratio by weight shall be 0.4.

G. The maximum elapsed time allowed from exiting of the material from the S/S processing unit to final placement of S/S material shall be 45 minutes.

H. The mixing unit shall have an automatic shutdown control that stops the unit in the event that water, cement, or fly ash feeds are interrupted.

I. Storage silos shall be equipped with low-level alarms to warn the operator.

Section 02215
Monolith Placement

Part 1 - General

1.1 Scope

This section describes the methods and procedures for placement and curing of the monolith.

1.2 Related Work

A. Division 1 of these Specifications.

B. Division 2 of these Specifications.

Part 2 - Products

Not used.

Part 3 - Execution

3.1 S/S Material Placement

A. Prior to placement of the first lift of S/S mixture, the exposed surface shall be graded, moistened (if necessary), compacted, and tested.

B. Prior to placement of lifts of S/S-processed materials onto S/S materials in place for 5 hours or more, the surface of the previous lift shall be broom swept, moisture conditioned, and treated as described in Section 3.3 of these Specifications.

C. S/S materials shall be placed in even and continuous horizontal layers with a maximum thickness of 12 inches. To the extent practicable, the surfaces of a minimum number of layers shall be exposed.

D. The outer edge of the compacted S/S layer shall be trimmed to a vertical face using the outer blade edge of the spreader or manually using a flat-ended shovel after each lift is compacted and before subsequent lifts are placed. Excess materials from this process shall be incorporated into ongoing S/S mixture placement or placed with the crushed rubble materials for reprocessing.

As an alternative compaction method for the outer edge of the compacted S/S layer, metals plates shall be used as forms for the placed S/S material. The forms shall be held in-place by inserting metal pins into the completed monolith layers. Placed S/S materials shall be compacted, and the forms and pins shall be removed after the placed S/S materials have developed sufficient strength that edge deterioration does not occur.

E. Placement of S/S-processed materials shall be accomplished by tracked equipment or other equipment capable of producing uniform layers that minimize disturbance to previously placed layers.

F. Tracked equipment for spreading shall be limited to a D-6 Caterpillar bulldozer or equivalent size that is equipped with hydraulic tilt and/or angle control blade. Tracked equipment shall only operate on uncompacted materials and shall not be allowed to turn or "crab" on the uncompacted materials.

G. S/S-processed materials at the outside edge of a spread layer shall be picked up and incorporated into the monolith or removed and placed with the crushed rubble for reprocessing.

H. S/S-processed materials shall not be placed upon a previous layer which has not been completely compacted, prepared, tested, and/or inspected by the Construction Inspector.

I. Placement operations shall be monitored by the Construction Inspector.

J. S/S-processed materials shall not be placed when ambient temperatures are less than 30°F. S/S-processed materials shall not be placed during precipitation events.

3.2 Compaction Procedures

A. Compaction of the monolith shall begin within 15 minutes of placement of the S/S mixtures.

B. A 563 Caterpillar, or comparable unit, smooth vibratory steel drum roller shall be used to compact the monolith.

C. A small vibratory roller and/or a power tamper shall be utilized to compact sections of the monolith that cannot be densified by the larger compaction equipment due to limited work space.

D. Rollers shall not be operated in vibratory mode unless moving.

E. All compaction equipment shall be maintained in good operating condition so that the S/S mixture is not contaminated with grease, oil, or other visible contaminants.

F. The time from the end of mixing until completion of compaction shall not exceed 45 minutes.

G. The in-place density of all accepted S/S mixture shall not be less than 90 percent of maximum dry density as determined through the feedstock testing performed under 3.4.B.1.c. of Section 01420 of these specifications for the feedstock in use at the time. In-place density tests shall be performed for every 500 cubic yards of S/S materials placed. Compaction shall proceed until the required in-place density is achieved.

3.3 Joints

Vertical and horizontal joints shall be kept in a clean, uncontaminated, and continuously moist condition until placement of overlying or adjacent S/S mixture to ensure appropriate bonding of materials. If more than 5 hours have elapsed before placement of overlying or adjacent S/S mixture, a cold joint shall be considered to have occurred. Horizontal and vertical cold joints shall be treated as described in the following sections.

A. Horizontal cold joint treatment shall consist of surface preparation and placement of concrete bedding. Horizontal cold joint surfaces shall be prepared for placement of the subsequent lift by removing all loose debris. Procedures for surface preparation shall include mechanical sweeping, air blasting, water blasting, or moderate pressure water jetting. Care shall be taken to prevent undercutting of aggregate in the S/S mixture. Water-jetting equipment shall be equipped with a suitable pressure regulator and a shut-off switch at the nozzle that automatically shuts off if the nozzle is dropped. Surface preparation shall be performed immediately prior to placement of the bedding mix. Bedding mix shall consist of dry cement applied at a rate of up to 5 pounds of cement per square yard. A light water mist shall be applied to the dry cement prior to placement of the next lift of S/S-processed materials.

B. Vertical cold joints shall be similar to horizontal cold joints. Vertical cold joint locations shall be noted during construction and offset no less than 6 inches from the vertical joints on the underlying lifts.

3.4 Curing and Protection

A. The surface of S/S-processed materials shall be maintained continuously moist, but not saturated, at a temperature above 35°F until it is covered by another placement layer. Any surface damaged by weather or construction activities shall be treated as a cold joint.

B. At the end of construction activities each day, exposed S/S-processed material surfaces shall be thoroughly moistened and covered with plastic to maintain a moist surface. Exposed surfaces of the S/S-processed materials which are the top layer shall be misted and protected a minimum of 14 days.

C. S/S-processed material surfaces shall be protected from temperatures below 35°F. Protection shall be provided by applying thermal blankets or other protection. Protection shall remain on the surface until the temperature rises above 35°F.

Section 02271
Recompacted Soil/Clay Layer

Part 1 – General

1.1 Scope

This section describes the work required to complete the RSCL component of the monolith cover system on the side slopes of the monolith.

1.2 Related Work

A. Division 1 of these Specifications.

B. Division 2 of these Specifications.

Part 2 – Products

2.1 Imported Soil

A. For all import materials to be used as RSCL, the following tests shall be performed once per source or when material changes as determined by the QA Manager:

1. Particle Size Distribution (ASTM 422)
2. Atterberg Limits (ASTM 4318)
3. USCS Classification (ASTM D 2487)
4. Constant Head Permeability (ASTM D 5084)
5. Modified Proctor (ASTM D 1557)
6. Consolidars-Undrained Triaxial Compression Test with Pore Pressure Measurement (ASTM D 4767)

Required samples will be taken by the Construction Inspector or his designated representative.

B. RSCL shall be classified according to the United Soil Classification System as CH or CL and shall meet the following gradation:

Sieve Size	Percent by Weight Passing Square Mesh Sieve
2 inches	100
0.75 inches	90
No. 200	50

C. The results of Constant Head Permeability testing shall indicate a hydraulic conductivity less than 1 x 10^{-7} centimeters per second.

D. All imported soil to be used as RSCL shall also be tested to confirm soil as below-action level.

E. The approved material supplier for the imported RSCL shall be Blue Stone Aggregates Company. Any change to or addition of material supplier shall require material testing in accordance with this specification.

Part 3 – Execution

3.1 Placement

A. Continuous and repeated visual inspection of the materials shall be performed to ensure proper soils are being used. In addition, the Construction Inspector shall make frequent inspections of the RSCL placement operations and shall consult with the site personnel on suitable RSCL materials and locations of such.

B. RSCL fill lift thickness shall be no greater than 8 inches prior to compaction. Thinner lifts are permissible to achieve design grade as specified on the Design Drawings.

C. Prior to compaction, particles greater than 2 inches shall be removed.

D. Each lift shall be thoroughly compacted and shall satisfy moisture and density controls through field testing before a subsequent lift is placed.

E. Compaction of lifts shall be as follows:

1. Compaction of lifts shall be performed with an appropriately heavy, properly ballasted, penetrating-foot compactor subject to approval of the Construction Inspector. The imprints from the compactor, minimum 1" in depth, shall be maintained for bonding with the subsequent lift.

2. The daily work area shall extend a distance no greater than necessary to maintain moist soil conditions (facilitate bonding) and continuous operations. Desiccation and crusting of the lift surface shall be avoided to the extent possible. Any material requiring moisture conditioning of more than 3 percentage points shall not be placed until 24 hours after water addition.

3. If desiccation and crusting of the lift surface occurs before placement of the next lift, this area shall be sprinkled with water and that scarified and tested for water content to ensure uniform moisture before placement of a subsequent lift.

4. Bulldozers shall not be used for primary compaction efforts.

F. Constant head permeability testing (ASTM D 5084) shall be performed on multiple samples obtained from discrete locations within the proposed borrow source. Samples shall be tested from 1 percent dry through 6 percent wet of optimum moisture content and at 90 percent to 100 percent of the maximum dry density as determined by the Modified Proctor test. A figure depicting dry unit weight versus molding water content shall be prepared based on test results and will be submitted. This figure shall be used for determination and verification of compaction requirements for compliance with permeability requirements. At least five samples shall be no more permeable than 1×10^{-7} centimeters per second as depicted on the figure and from testing results.

G. Sand cone density testing (ASTM D 1556) shall occur at locations designated by the construction inspector and at a frequency of 1 per 500 cubic yards of placed RSCL, 1 per day minimum, to ensure the RSCL fill is compacted to a minimum dry density of the applicable percentage of the maximum dry density as determined by the Modified Proctor test (ASTM D 1557) based upon moisture content within 1 percent dry of optimum to 6 percent wet of optimum. Densities less than the applicable percentage of the maximum dry density determined from the Modified Proctor test shall be recompacted and/or removed and reworked to meet density objectives.

H. Frozen soil shall not be compacted to construct the RSCL, nor shall the RSCL be placed on frozen soil.

I. During construction, finished lifts or sections of RSCL fill may be sprinkled with water as needed to prevent drying and desiccation.

J. The RSCL shall be at least 18 inches thick down the side slopes of the monolith only. Thickness of the RSCL on the side slopes shall be measured perpendicular to the slope face.

K. Completed segments of the RSCL shall be tested daily for excessive moisture or desiccation prior to placement of subsequent lifts of material. Moisture content testing shall be performed 1 inch below the previously completed surface and shall indicate a minimum value of 1% below average optimum moisture content as determined in Part 3.1.F. above.

Section 02275
Riprap Placement

Part 1 - General

1.1 Scope

This section describes placement of the riprap component of the monolith cover system.

1.2 Related Work

A. Division 1 of these Specifications.

B. Division 2 of these Specifications.

1.3 Submittals

A. Supplier certification that riprap complies with the requirements of this specification.

B. Comply with the provisions of Section 01340 of these Specifications.

Part 2 - Products

2.1 Riprap

A. Riprap utilized in the construction of the top layer of the monolith cover system shall be of a grade with a D_{50} size of at least 9 inches. The range of size shall be not less than 3 inches in diameter and not greater than 15 inches in diameter. Materials described as meeting Type L Grade riprap as described in the Denver Urban Storm Drainage Criteria Manual.

B. Riprap shall consist of hard, durable, angular stone. It shall be free from cracks, organic matter, clay, and other deleterious materials.

C. The quality of the riprap material shall conform to the requirements set forth in the Determination of Riprap Quality Assessment Criteria included in Appendix B.

Part 3 - Execution

3.1 Riprap Placement

A. Riprap shall be placed over the filter and drainage layer materials to a minimum thickness of 18 inches.

B. Riprap shall be placed in a manner that shall not damage the geosynthetic clay liner underlying the filter drainage materials. Riprap shall not be dropped from a height exceeding 6 feet.

C. Hand placement of smaller riprap stones and rearranging of larger riprap stones by mechanical equipment shall be performed as needed to obtain the minimum thickness and improve stability of the placed riprap.

D. The Construction Inspector will monitor placement of riprap.

Section 02280
Materials Handling

Part 1 - General

1.1 Scope

This section describes the materials handling requirements for excavation and S/S activities. The intent of this Specification is to provide for efficient material handling during Phase II construction. Material handling activities covered by this Specification include, but are not limited to, material transport, stockpile construction and maintenance, feedstock preparation, and rubble-crushing operations.

1.2 Related Work

A. Division 1 of these Specifications.

B. Division 2 of these Specifications.

Part 2 - Products

Not used.

Part 3 - Execution

3.1 General

Excavation and S/S processing rates shall be balanced to the extent practicable to minimize the size of the open excavation and materials requiring stockpiling.

3.2 Excavation Stages

The material handling plan shall be performed in a series of stages:

A. Above-action-level soil shall be excavated and transported to the feedstock preparation area.

B. After verification and confirmation sampling and analysis are performed to confirm that all above-action-level soil has been removed, below-action-level soil shall be removed to the monolith base elevation.

C. If any above-action-level soil extends below the monolith base elevation, the material shall be excavated.

D. The depression resulting from excavation below the monolith base elevation shall be backfilled with coarse-grained imported fill at elevations below the maximum recorded or expected groundwater elevation. At elevations above the maximum recorded or expected groundwater elevation, backfill will be completed to the monolith base elevation using below-action-level soil.

3.3 Material Transport

A. Materials shall be transported by heavy equipment or conveyors.

B. Traffic routes shall be selected to minimize the overall haul distances.

C. Transportation routes shown on the Drawings shall be wetted as necessary to control dust.

D. On site, the maximum speed limit for excavation and load-out equipment shall be 15 miles per hour.

E. Loading shall be performed in a manner which minimizes the potential for spillage of materials during loading operations. Materials shall be placed in the haul trucks so they do not extend above the sides of the truck bed.

F. All transportation equipment operating in fill placement areas shall be operated in a manner which precludes tight turns, sudden stops, or other procedures that could damage previously compacted layers.

G. Haul traffic on top of the compacted layers of S/S mixture shall be limited to minimize the amount of mud, snow, and other debris tracked onto the monolith.

H. Conveyors shall be of a size capable of transporting soil and S/S materials.

I. To minimize material carry-over on the conveyor, each conveyor will be equipped with a wipe blade which will remove sticking material from the conveyor belt. To minimize the potential for cross contamination due to possible spillage of material, the conveyor system will be placed on a 20-mil HDPE liner when above-action-level soil or S/S materials are transported over below-action-level soil. This liner will be bermed to retain spillage and will be placed beneath each section of the conveyor, including the discharge chutes and hoppers. Above-action-level soil spilled onto the liner will be returned to the conveyor belt. S/S materials spilled onto the liner will be stockpiled in the oversized screened materials stockpile for reprocessing. Spillage of material from the conveyor outside the liner containment area will require the operator review and adjust conveyor and pugmill operations to address the problem.

3.4 Stockpile Construction and Maintenance

A. Place HDPE Liner up to 20-mil thickness below above-action-level stockpiles in the event that placement occurs on a below-action-level soil surface or on the monolith.

B. Place HDPE liner up to 20-mil thickness beneath all below-action-level stockpiles.

C. HDPE liner seams will be overlapped 1 foot and oriented with respect to site grades to minimize the potential for water seepage to enter the overlap zone.

D. No stockpile shall be more than approximately 30 feet high.

E. Stockpiles shall be sloped to drain surface water. Surface runoff shall be diverted to ditches and collection points for transport to the storm water retention area.

F. Stockpiles shall be sprayed with water as necessary to control dust.

G. No stockpile shall be located within 20 feet of the fenced site perimeter to provide a buffer zone during construction and to allow access around the perimeter of the site.

H. All stockpiling of above-action-level and below-action-level soil shall be within the fenced perimeter of the Bannock Street Site work area.

I. High visibility tape will be placed around the above-action-level and below-action-level soil stockpiles and the screened oversized material stockpile.

J. Temporary signs will be posted to indicate the nature of the materials stored in these areas.

K. All soil stockpiles shall be covered when not in use to prevent excess sediment generation and minimize fugitive emissions.

L. Runoff from stockpiles shall be directed toward drainage ditches.

3.5 Stabilization Material Handling

Fly ash and cement utilized in the S/S processing shall be stored in silos outside the restricted area.

3.6 Material Preparation Prior to Processing

A. After the foundation preparation is completed, the above-action-level soil and crushed rubble shall be prepared in the feedstock preparation area.

B. Feedstock materials will be transported to the processing area by conveyors and/or haul trucks.

C. Material will be processed in accordance with Section 02210.

3.7 Handling of Processed Materials

A. S/S-processed materials shall be transported to the placement area by conveyors and/or haul trucks.

B. Material will be placed and compacted in accordance with Section 02215.

Section 02774
Filter Drainage Layer

Part 1 - General

1.1 Scope

This section details the materials and placement of the filter drainage layer component of the monolith cover system.

1.2 Related Work

A. Division 1 of these Specifications.

B. Division 2 of these Specifications.

1.3 Submittals

Supplier certification for Class C sand and Class A gravel as described in the State of Colorado, Division of Highways, Standard Specification 703.09.

Part 2 - Products

2.1 Filter Drainage Material

A. Class C Sand meeting the State of Colorado, Division of Highways, Standard Specification 703.09.

B. Class A Gravel meeting the State of Colorado, Division of Highways, Standard Specification 703.09.

Part 3 - Execution

3.1 Placement

A. On the top of the monolith, the filter drainage layer shall be placed on the geosynthetic clay liner (GCL) specified in Section 02778 utilizing mechanical or manual methods and shall be spread uniformly prior to compaction. The filter drainage layer will consist of a 12 inch thick layer of Class C sand overlying the GCL and a 6 inch thick layer of Class A gravel overlying the sand layer.

Care shall be taken to avoid damaging the GCL during placement of the filter drainage layer. Should the GCL be damaged in any way, repairs to the liner shall be made immediately in accordance with Section 02778 of these Specifications.

B. On the side slopes, the filter drainage layer shall be placed on the compacted RSCL specified in Section 02271 utilizing mechanical or manual methods and shall be spread uniformly prior to compaction. The filter drainage layer will consist of a 6 inch thick layer of Class C sand overlying the RSCL and a 6 inch thick layer of Class A gravel overlying the sand layer.

C. The filter drainage layer shall be compacted to the extent that displacement of the material is not observed when the surface is transversed by compaction equipment.

Section 02778
Geosynthetic Clay Liner

Part 1 – General

1.1 Scope

This section describes the Work necessary for installation of the Geosynthetic Clay Liner (GCL) component of the monolith cover system. The GCLs shall consist of a layer of natural sodium bentonite clay encapsulated between two geotextiles and shall comply with all of the criteria listed in this Section.

1.2 Relate Work

A. Division 1 of these specifications.

B. Division 2 of these specifications.

1.3 Submittals

A. Furnish the GCL manufacturer's Quality Assurance/Quality Control (QA/QC) certifications to verify that the materials supplied for the project are in accordance with requirements of this specification.

B. As installation proceeds, submit certificates of supgrade acceptance, signed by the Contractor, and Construction Inspector for each area that is covered by the GCL.

Part 2 – Products

2.1 Material Requirements

A. The acceptable GCL product is Clay Max 200R as manufactured by CETCO, 1350 West Shure rive, Arlington Heights, Illinois 60004 USA (708-392-5800), or an engineer-approved equal.

B. The GCL and its components shall have the properties shown in Table 1.

Table 1. Required Properties for GCL

Material Property	Test Method	Required Values(1)
Bentonite Free Swell	ASTM D 5890	24 mL/2g min.
Bentonite Fluid Loss	ASTM D 5891	18 mL max.
Bentonite Mass/Area	ASTM D 5993	0.75 obs/ft(2) (3.6 kg/m^2)
GCL Grab Strength(2)	ASTM D 4632	76 lbs.
GCL Permeability(3)	ASTM D 5084	5 x 10^{-9} cm/sec
GCL Hydrated Internal Shear Strength(4)	ASTM D 5321	50 psf typical

Notes:

(1)All values minimum average roll values unless otherwise indicated.
(2)Tensile testing performed in the machine direction.
(3)Permeability with desired distilled water at 80 psi cell pressure, 77 psi headwater and 75 psi tailwater pressure.
(4)Peak value measures at 200 psf normal stress.

C. The minimum acceptable dimensions of full-size GCL panels shall be 13.8 feet in width and 150 feet in length. Short rolls (those manufactured to a length greater than 70 feet but less than a full-length roll) may be supplied at a rate no greater than 3 per truckload or 3 rolls every 36,000 square of GCL, whichever is less.

D. A 6-inch overlap guideline shall be imprinted on both edges of the upper geotextile component of the GCL as a means for providing quality assurance of the overlap dimension. Lines shall be printed in easily visible nontoxic ink.

2.2 Product Quality Documentation

The GCL manufacturer shall provide the QA Manager with manufacturing QA/QC certifications for each shipment of GCL. The certifications shall be signed by a responsible party employed by the GCL Manufacturer and shall include:

A. Certificates of analysis for the bentonite clay used in GCL production demonstrating compliance with the parameters shown in Table 1.

B. Test data for geotextile materials use in GCL production, including, at a minimum, mass/area data and tensile test data demonstrating compliance with the GCL manufacturer's Material Quality Control Plan.

C. GCL lot and roll numbers supplied for the project (with corresponding shipping information).

D. Manufacturer's test data for the finished GCL product, including the parameters of bentonite, mass/area, tensile strength, and representative permeability data demonstrating compliance with the performance parameters shown in Table 1.

2.3 Product Labeling

Prior to shipment, the GCL manufacturer shall label each roll, identifying:

1. Product identification information (Manufacturer's name and address, brand name, product code).

2. Lot number and roll number.

3. Roll length, width, and weight.

2.4 Packaging

A. The GCL shall be wound around a rigid core whose diameter is sufficient to facilitate handling. The core is not necessarily intended to support the roll for lifting but should be sufficiently strong to prevent collapse during transit.

B. All rolls shall be labeled and bagged in packaging that is resistent to photodegradation by ultraviolet (UV) light.

2.5 Accessor Bentonite

The granular bentonite or bentonite sealing compound, if required, used for seaming, penetration sealing, and repairs shall be made from the same natural sodium bentonite as used in the GCL and shall be as recommended by the GCL manufacturer.

Part 3.0 – Execution

3.1 Shipping and Handling

A. The manufacturer assumes responsibility for initial loading the GCL. Shipping will be the responsibility of the party paying the freight. Unloading, on-site handling, and storage of the GCL are the responsibility of the Contractor, Installer, or other designated party.

B. A visual inspection of each roll should be made during unloading to identify if any packaging has been damaged. Rolls with damaged packaging should be marked and set aside for further inspection. The packaging should be repaired prior to being placed in storage.

C. The party responsible for unloading the GCL should contact the Manufacturer prior to shipment to ascertain the appropriateness of the proposed unloading methods and equipment.

3.2 Storage

A. Storage of the GCL rolls shall be the responsibility of the Installer. A dedicated storage area shall be selected at the job site that is away from high traffic areas and is level, dry, and well drained.

B. Rolls should be stored in a manner that prevents sliding or rolling from the stacks and may be accomplished by the use of chock blocks or by use of the dunnage shipped between rolls. Rolls should be stacked at a height no higher than that at which the lifting apparatus can be safely handled (typically no higher than four).

C. All stored GCL materials and the accessory bentonite must be covered with a plastic sheet or tarpaulin until their installation.

D. The integrity and legibility of the labels shall be preserved during storage.

3.3 Earthwork

A. Any earthen surface upon which the GCL is installed shall be prepared and compacted in accordance with the project specifications and drawings. The surface shall be smooth, firm, and unyielding, and free of:

1. Vegetation
2. Construction debris
3. Sticks
4. Sharp rocks
5. Void spaces
6. Ice
7. Abrupt elevation changes
8. Standing water
9. Cracks larger than one-quarter inch in width
10. Any other foreign matter that could contact the GCL

B. Immediately prior to GCL deployment, the subgrade shall be final graded to fill in all voids or cracks and then smooth rolled to provide the best practicable surface for the GCL. At completion of this activity, no wheel ruts, footprints, or other irregularities shall exist in the subgrade. Furthermore, all protrusions extending more than one-half inch from the surface shall either be removed, crushed, or pushed into the surface with a smooth-drum compactor.

C. On a continuing basis, the project CQA inspector shall certify acceptance of the subgrade before GCL placement.

D. It shall be the Installer's responsibility thereafter to indicate to the Engineer any change in the condition of the subgrade that could cause the subgrade to be out of compliance with any of the requirements listed in this Section.

E. The GCL shall be anchored in accordance with the project plans.

3.4 GCL Placement

A. GCL shall be placed where indicated on the project drawings.

B. GCL rolls should be delivered to the working area of the site in their original packaging. Immediately prior to deployment, the packaging should be carefully removed without damaging the GCL. The orientation of the GCL (i.e., which side faces up) should be in accordance with the Engineer's or Manufacturer's recommendations. Unless otherwise specified, however, the GCL shall be installed such that the product name printed on one side of the GCL faces up.

C. Equipment which could damage the GCL shall not be allowed to travel directly on it. If the installation equipment causes rutting of the subgrade, the subgrade must be restored to its originally accepted condition before placement continues.

D. Care must be taken to minimize the extent to which the GCL is dragged across the subgrade in order to avoid damage to the bottom surface of the GCL. A temporary geosynthetic subgrade covering commonly known as a slip sheet or rub sheet may be used to reduce friction damage during placement.

E. The GCL shall be placed so that seams are perpendicular to the direction of the slope. Seams should be located at least 3 feet from the toe and crest of slopes steeper than 4H:1V. Upslope panels shall overlay downslope panels.

F. All GCL panels should lie flat on the underlying surface, with no wrinkles or fold, especially at the exposed edges of the panels.

G. Only as much GCL shall be deployed as can be covered at the end of the working day with soil, or a temporary waterproof tarpaulin. The GCL shall not be left uncovered overnight. If the GCL is hydrated when no confining stress is present, it may be necessary to remove and replace the hydrated material. The project Engineer, CQA inspector, and GCL supplier should be consulted for specific guidance if premature hydration occurs.

3.5 Seaming

A. The GCL seams are constructed by overlapping their adjacent edges. Care should be taken to ensure that the overlap zone is not contaminated with loose soil or other debris.

B. The minimum dimension of the longitudinal overlap should be 6 inches. End-of-roli overlapped seams should be similarly constructed, but the minimum overlap should measure 12 inches.

C. Seams at the ends of the panels should be constructed such that they are shingled in the direction of the grade to prevent the potential for runoff flow to enter the overlap zone.

3.6 Detail Work

A. The GCL shall be sealed around penetrations and embedded structures in accordance with the design drawings and the GCL Manufacturer.

B. Cutting the GCL should be performed using a sharp utility knife. Frequent blade changes are recommended to avoid damage to the geotextile components of the GCL during the cutting process.

3.7 Damage Repair

A. If the GCL is damaged (torn, punctured, perforated, etc.) during installation, it may be possible to repair it by cutting a parch to fit over the damaged area. The patch shall be obtained from a new GCL roll and shall be cut to size such that a minimum overlap of 12 inches is achieved around all the damaged area.

Section 02930
Seeding and Mulching

Part 1 - General

1.1 Scope

This section describes the services for final grading, seeding, fertilizing, mulching, and miscellaneous work required to complete revegetation of disturbed areas as specified herein.

1.2 Related Work

A. Division 1 sections of these Specifications.

B. Division 2 sections of these Specifications.

1.3 Implementation

Revegetate the areas disturbed by the soil remediation activities no later than 3 days after backfilling activities have been completed.

1.4 Quality Assurance

All seed and fertilizer shall be checked prior to seeding operations. No seeding shall be performed without inspection by the Construction Inspector. The Construction Inspector shall be notified at least 24 hours in advance of seeding operations.

1.5 Submittals

Certification of seed mixture, purity, germinating value, and crop year identification.

Part 2 - Products

2.1 Seed

Seed mixture will be as follows:

Species	Variety	Percent of Mix	Pounds PLS[1]/Acre (Drilled Planting)
Western wheatgrass	Arriba	40	6.4
Blue grama	Lovington	25	0.9
Sideoats grama	Vaughn	15	1.4
Buffalograss	Native	10	1.7
Little bluestem	Pastura	10	0.7
Total		100	11.1

[1]PLS = Pure Live Seed, a reflection of the amount of viable seed of specified species. (In a bag of bulk seed, % PLS = % Purity x % Germination/100).

2.2 Fertilizer

A. Fertilizer shall be uniform in composition, free flowing, and delivered to the site fully labeled according to applicable state laws and shall bear the name, trade name, or trademark and warranty of the producer.

B. The contractor may submit soil samples to the Colorado State Department of Agriculture laboratory for fertilizer recommendations. Recommendations shall be submitted to the Construction Inspector for approval prior to implementation.

C. Fertilize using 10-20-10 or equivalent at the rate of 600 pounds per acre or 15 pounds per 1,000 square feet.

2.3 Mulch

Mulch shall be long-stemmed, weed and seed-free grass hay. Cereal straw (wheat, barley, and oats) may be used as an alternative.

Part 3 - Execution

3.1 Seeding

A. Upon completion of finish grading, the soil surface shall be examined visually for organic content and water retention capability by the Construction Inspector.

B. Where directed by the Construction Inspector, stones and debris over 6 inches or which would interfere with maintenance shall be removed from the soil. An evenly finished surface shall be provided.

C. Apply lime and fertilizer at the rates specified in Section 2.2 of these Specifications.

D. Apply seed using a grass (or rangeland) drill with 7- to 12-inch row spacing equipped with separate seed boxes to facilitate the planting of large and small seed simultaneously, seed box agitators, double disk furrow openers, depth bands on each disk, and packer wheels or drag chains.

E. Drilling speed is limited to 4 to 4.5 miles per hour

3.2 Mulching

A. Immediately after seeding, apply mulch at a rate of 1.5 to 2.0 tons per acre.

B. Anchor mulch using a crimping machine to a depth of approximately 4 inches.

Section 01010
Summary of the Work

Part 1 - General

1.1 Description of the Project

A. Site Description

Denver Radium Site Operable Unit VIII is located in southwest Denver, northeast of the intersection of Evans Avenue and Santa Fe Drive. The site includes the 5.9 acres on which The S. W. Shattuck Chemical Company, Inc. (Shattuck) mineral processing facility was located.

B. Project Description

The Work for this project involves the Phase II construction activities including Excavation and Stabilization/Solidification (S/S) for the Denver Radium Site Operable Unit VIII. Phase II Work generally consists of the excavation of above-action-level and below-action-level soil from the Bannock Street Site and the S/S processing of above-action-level soil and crushed rubble to create a monolith on site.

The above-action-level soil will be treated by the S/S process. Below-action-level soil will be used in the construction and grading of the monolith foundation, and for general site grading.

The scope of work includes all labor, equipment, tools, materials, and services needed to accomplish all excavation, processing, placement of stabilized/solidified soils, construction of a cover system, and general cover as well as any incidental work as described herein or shown on the Drawings necessary to properly complete the Work.

1.2 Related Work

A. Division 1 sections of these Specifications.

B. Division 2 sections of these Specifications.

1.3 Definitions

A. "Above-Action-Level Soil" - Soils with concentrations of constituents of concern above those specified in Table 9-2 of the Record of Decision (ROD), except as modified by the U.S. Environmental Protection Agency (USEPA) letter to the Colorado Department of Public Health and Environment (CDPHE) dated January 16, 1992 which modified the generic protocol for excavation of Thorium-230.

B. "Below-Action-Level Soil" - Soils with concentrations of constituents of concern below those specified in Table 9-2 of the ROD, except as modified by the USEPA letter to the CDPHE dated January 16, 1992 which modified the generic protocol for excavation of Thorium-230.

C. "Cement" - A dry powder made from silica, alumina, lime, iron oxide, and magnesia used in the S/S process.

D. "Common Fill" - Imported clean fill suitable for use where indicated in the plans and specifications from an approved off-site location.

E. "Crushed Rubble" - Rubble resulting from crushing of stone and/or concrete slabs, bricks, and block from buildings and structures from vicinity properties and the Bannock Street Site.

F. "Excavation" - Removal of material to reach the lines, grades, and elevations shown on the drawings or as determined by above-action-level excavation control, verification or confirmation sampling.

G. "Excavation Confirmation Sample" - Above-action-level soil excavation verification sample to be confirmed through off-site laboratory analysis.

H. "Excavation Control Sample" - A sample collected for opposed crystal system (OCS) analysis to assist in delineating the extent of excavation.

I. Excavation "Verification Sample" - Composite sample used to determine limit of above-action-level soil excavation.

J. "Feedstock Material" - Above-action-level soil and crushed rubble prepared for S/S processing.

K. "Fly Ash" - Noncombustible fine particulate refuse from an approved supplier used in the S/S process.

L. "Lift" - A uniform layer of material placed in accordance with these Specifications.

M. "Percent Maximum Density" - A percentage of the maximum density at optimum moisture content obtained by specified American Society for Testing and Materials (ASTM) density testing methods.

N. "Perimeter Air Monitoring Program" - Plan for air monitoring along the perimeter of the Bannock Street Site utilizing air monitoring stations for collection of high-volume air samples. The plan is presented in the current Phase II Air Monitoring Plan.

O. "Personal Air Samples" - Personal air samples collected from personnel who may be potentially exposed to respiratory hazards during Phase II activities.

P. "Preplacement Material Sampling" - Samples of the processed S/S materials collected prior to placement.

Q. "Preprocessing Material Samples" - Samples of the prepared feedstock material collected prior to the S/S processing.

R. "Process Water" - Water used in the S/S process that meets the requirement of ASTM C 94.

S. "Radiological Surveys" - Surveys performed to evaluate the presence of radioactivity and/or radionuclides.

T. "Recompacted Soil/Clay Layer" (RSCL) - The natural barrier with a maximum permeability of 1×10^{-7} centimeter per second which serves as the barrier between the top of the monolith and the geosynthetic clay liner.

U. "Soils" - Unconsolidated material found above bedrock including, but not limited to, gravel, sand, silt, and clay. Vegetation such as sod is not considered soil and is removed prior to collection of samples.

V. "Subgrade Preparation" - Fine grading and compaction of existing ground or placed backfill upon which S/S-processed materials shall be placed.

W. "Unsatisfactory Fill Materials" - Soils unsatisfactory for fills including, but not limited to, materials containing organic matter, trash, debris, frozen materials, materials containing radioactivity or other hazardous contaminants in excess of ROD and/or regulatory standards, and materials which do not meet the requirements of Division 2. Materials which are unsatisfactory due to excessive or insufficient moisture or gradation may be used if screening, manipulation, aerating, watering, or preparing with other suitable materials results in acceptable properties.

X. Vicinity Properties - Properties in the vicinity of the Bannock Street Site remediated under Phase I activities.

Part 2 - Products

Not used.

Part 3 - Execution

3.1 Scope of Work

The Work for this project includes furnishing all labor, tools, equipment, materials, transportation, services, and incidentals, and performing all operations necessary for the Work as shown and noted on the Drawings and as required in these Specifications. The Work for this project includes, but is not limited to, the following:

A. Excavation of above-action-level soil for S/S processing. Excavation of below-action-level soil and/or backfill of below-action-level soil/common fill to achieve the base elevation of the monolith in an area of sufficient size to hold all S/S materials.

B. Implementation of materials sequencing and handling to allow for segregation and preparation of above-action-level soil. Below-action-level soil shall be segregated from above-action-level soil.

C. Stockpiles shall be covered to prevent erosion due to wind and water.

D. S/S processing of the excavated above-action-level soil. S/S shall be performed on excavated above-action-level soil as well as crushed rubble from the Bannock Street Site and Vicinity Properties.

E. Placement of the S/S-processed material in a monolith.

F. Construction of a cover system for the monolith consisting of, an RSCL, a GCL, a filter drainage layer, and riprap.

G. Construction and vegetation of a general cover for the remainder of the site consisting of below-action-level soil and/or common fill.

3.2 Construction Sequence

Except as specifically noted, the construction sequence described below is intended as guidance for this project. To the extent practicable, multiple tasks may be done simultaneously.

A. Mobilization

Mobilize as detailed in the current Phase II Mobilization Plan.

B. Soil Excavation

1. Excavate above-action-level soil until Opposed Crystal System (OCS) gamma radiation counter and shielded gamma scintillometer measurements indicate complete removal of above-action-level soil. Excavation is not complete until the confirmation from an off-site laboratory shows that all above-action-level soil has been removed.

2. If necessary, excavate below-action-level soil as required to achieve plan grades.

C. Foundation Preparation

In areas where above-action-level soil is excavated below the elevation of the monolith foundation, the area shall be backfilled with below-action-level soil or common fill and compacted for preparation of the monolith foundation. In areas where below-action-level soil is excavated to achieve monolith foundation grades, the monolith foundation shall be compacted and prepared as required by the appropriate specifications.

D. S/S and Monolith Construction

1. Above-action-level soil and crushed rubble shall be processed in accordance with Section 02210 of these Specifications.

2. Stabilized/solidified materials shall be placed into a monolith in accordance with Section 02215 of these Specifications.

E. Cover System and General Cover Construction

1. The completed monolith shall be covered with the following:

   a. Top: a 6-inch-thick RSCL, a GCL, an 18-inch-thick filter drainage layer, and an 18-inch-thick riprap layer.

   b. Sideslopes: an 18-inch-thick RSCL, a 12-inch-thick filter drainage layer, and an 18-inch-thick riprap layer

2. The remainder of the site shall be covered with below-action-level soil/common fill.

3.3 Work Quality Assurance (QA)

A. Shop and fieldwork shall be performed by personnel trained and experienced in field construction techniques. Work on this project shall be performed in accordance with the standard industry practices for the various construction trades involved.

B. Work shall be erected and installed plumb, level, and square and true, or true to indicated angle(s), and in proper alignment and relationship.

C. A qualified Construction Inspector shall review all construction activities conducted under these Specifications.

D. All QA Work shall conform to the requirements set forth in the Construction Quality Assurance Plan (CQAP) and the Quality Assurance Project Plan (QAPP).

Section 01020
Health and Safety

Part 1 - General

1.1 Scope

A. This section describes the project health and safety requirements, equipment, and personnel decontamination requirements, and procedures which will be required to be used during Phase II. Contractors and Subcontractors may conduct activities under their own health and safety plans provided such plans are no less protective of worker health and safety than the requirements set forth in these Specifications. A designated Health and Safety Officer and the Site Supervisor shall determine the adequacy of any Contractor's or Subcontractor's health and safety plans prior to their use at the Bannock Street Site.

B. Related Work

1. Division 1 sections of these Specifications.

2. Division 2 sections of these Specifications.

Part 2 - Products

Not used.

Part 3 - Execution

3.1 Phase II - Site Safety Compliance

Project management activities associated with health and safety shall be conducted in accordance with this Specification and the Phase II Site Safety Plan (SSP). Task description and hazard evaluation details are provided in Chapter 3.0 of the Phase II - SSP.

3.2 Personnel Safety and Training

A. Personnel Safety

All necessary safeguards shall be taken to ensure the safety of workers during the remedial action (RA). These shall include, but not be limited to, the following:

1. Workers shall not be permitted underneath loads handled by lifting or digging equipment. Personnel are required to stand away from any vehicles being loaded or unloaded to avoid being struck by any spillage or falling materials.

Section 02774
Filter Drainage Layer

Part 1 - General

1.1 Scope

This section details the materials and placement of the filter drainage layer component of the monolith cover system.

1.2 Related Work

A. Division 1 of these Specifications.

B. Division 2 of these Specifications.

1.3 Submittals

Supplier certification for Class C sand and Class A gravel as described in the State of Colorado, Division of Highways, Standard Specification 703.09.

Part 2 - Products

2.1 Filter Drainage Material

A. Class C Sand meeting the State of Colorado, Division of Highways, Standard Specification 703.09.

B. Class A Gravel meeting the State of Colorado, Division of Highways, Standard Specification 703.09.

Part 3 - Execution

3.1 Placement

A. On the top of the monolith, the filter drainage layer shall be placed on the geosynthetic clay liner (GCL) specified in Section 02778 utilizing mechanical or manual methods and shall be spread uniformly prior to compaction. The filter drainage layer will consist of a 12 inch thick layer of Class C sand overlying the GCL and a 6 inch thick layer of Class A gravel overlying the sand layer.

Care shall be taken to avoid damaging the GCL during placement of the filter drainage layer. Should the GCL be damaged in any way, repairs to the liner shall be made immediately in accordance with Section 02778 of these Specifications.

B. On the side slopes, the filter drainage layer shall be placed on the compacted RSCL specified in Section 02271 utilizing mechanical or manual methods and shall be spread uniformly prior to compaction. The filter drainage layer will consist of a 6 inch thick layer of Class C sand overlying the RSCL and a 6 inch thick layer of Class A gravel overlying the sand layer.

C. The filter drainage layer shall be compacted to the extent that displacement of the material is not observed when the surface is transversed by compaction equipment.

Section 02778
Geosynthetic Clay Liner

Part 1 – General

1.1 Scope

This section describes the Work necessary for installation of the Geosynthetic Clay Liner (GCL) component of the monolith cover system. The GCLs shall consist of a layer of natural sodium bentonite clay encapsulated between two geotextiles and shall comply with all of the criteria listed in this Section.

1.2 Relate Work

A. Division 1 of these specifications.

B. Division 2 of these specifications.

1.3 Submittals

A. Furnish the GCL manufacturer's Quality Assurance/Quality Control (QA/QC) certifications to verify that the materials supplied for the project are in accordance with requirements of this specification.

B. As installation proceeds, submit certificates of supgrade acceptance, signed by the Contractor, and Construction Inspector for each area that is covered by the GCL.

Part 2 – Products

2.1 Material Requirements

A. The acceptable GCL product is Clay Max 200R as manufactured by CETCO, 1350 West Shure rive, Arlington Heights, Illinois 60004 USA (708-392-5800), or an engineer-approved equal.

B. The GCL and its components shall have the properties shown in Table 1.

Table 1. Required Properties for GCL

Material Property	Test Method	Required Values[1]
Bentonite Free Swell	ASTM D 5890	24 mL/2g min.
Bentonite Fluid Loss	ASTM D 5891	18 mL max.
Bentonite Mass/Area	ASTM D 5993	0.75 obs/ft[2] (3.6 kg/m^2)
GCL Grab Strength[2]	ASTM D 4632	76 lbs.
GCL Permeability[3]	ASTM D 5084	5×10^{-9} cm/sec
GCL Hydrated Internal Shear Strength[4]	ASTM D 5321	50 psf typical

Notes:

[1]All values minimum average roll values unless otherwise indicated.
[2]Tensile testing performed in the machine direction.
[3]Permeability with desired distilled water at 80 psi cell pressure, 77 psi headwater and 75 psi tailwater pressure.
[4]Peak value measures at 200 psf normal stress.

C. The minimum acceptable dimensions of full-size GCL panels shall be 13.8 feet in width and 150 feet in length. Short rolls (those manufactured to a length greater than 70 feet but less than a full-length roll) may be supplied at a rate no greater than 3 per truckload or 3 rolls every 36,000 square of GCL, whichever is less.

D. A 6-inch overlap guideline shall be imprinted on both edges of the upper geotextile component of the GCL as a means for providing quality assurance of the overlap dimension. Lines shall be printed in easily visible nontoxic ink.

2.2 Product Quality Documentation

The GCL manufacturer shall provide the QA Manager with manufacturing QA/QC certifications for each shipment of GCL. The certifications shall be signed by a responsible party employed by the GCL Manufacturer and shall include:

A. Certificates of analysis for the bentonite clay used in GCL production demonstrating compliance with the parameters shown in Table 1.

B. Test data for geotextile materials use in GCL production, including, at a minimum, mass/area data and tensile test data demonstrating compliance with the GCL manufacturer's Material Quality Control Plan.

C. GCL lot and roll numbers supplied for the project (with corresponding shipping information).

D. Manufacturer's test data for the finished GCL product, including the parameters of bentonite, mass/area, tensile strength, and representative permeability data demonstrating compliance with the performance parameters shown in Table 1.

2.3 Product Labeling

Prior to shipment, the GCL manufacturer shall label each roll, identifying:

1. Product identification information (Manufacturer's name and address, brand name, product code).

2. Lot number and roll number.

3. Roll length, width, and weight.

2.4 Packaging

A. The GCL shall be wound around a rigid core whose diameter is sufficient to facilitate handling. The core is not necessarily intended to support the roll for lifting but should be sufficiently strong to prevent collapse during transit.

B. All rolls shall be labeled and bagged in packaging that is resistent to photodegradation by ultraviolet (UV) light.

2.5 Accessor Bentonite

The granular bentonite or bentonite sealing compound, if required, used for seaming, penetration sealing, and repairs shall be made from the same natural sodium bentonite as used in the GCL and shall be as recommended by the GCL manufacturer.

Part 3.0 – Execution

3.1 Shipping and Handling

A. The manufacturer assumes responsibility for initial loading the GCL. Shipping will be the responsibility of the party paying the freight. Unloading, on-site handling, and storage of the GCL are the responsibility of the Contractor, Installer, or other designated party.

B. A visual inspection of each roll should be made during unloading to identify if any packaging has been damaged. Rolls with damaged packaging should be marked and set aside for further inspection. The packaging should be repaired prior to being placed in storage.

C. The party responsible for unloading the GCL should contact the Manufacturer prior to shipment to ascertain the appropriateness of the proposed unloading methods and equipment.

3.2 Storage

A. Storage of the GCL rolls shall be the responsibility of the Installer. A dedicated storage area shall be selected at the job site that is away from high traffic areas and is level, dry, and well drained.

B. Rolls should be stored in a manner that prevents sliding or rolling from the stacks and may be accomplished by the use of chock blocks or by use of the dunnage shipped between rolls. Rolls should be stacked at a height no higher than that at which the lifting apparatus can be safely handled (typically no higher than four).

C. All stored GCL materials and the accessory bentonite must be covered with a plastic sheet or tarpaulin until their installation.

D. The integrity and legibility of the labels shall be preserved during storage.

3.3 Earthwork

A. Any earthen surface upon which the GCL is installed shall be prepared and compacted in accordance with the project specifications and drawings. The surface shall be smooth, firm, and unyielding, and free of:

1. Vegetation
2. Construction debris
3. Sticks
4. Sharp rocks
5. Void spaces
6. Ice
7. Abrupt elevation changes
8. Standing water
9. Cracks larger than one-quarter inch in width
10. Any other foreign matter that could contact the GCL

B. Immediately prior to GCL deployment, the subgrade shall be final graded to fill in all voids or cracks and then smooth rolled to provide the best practicable surface for the GCL. At completion of this activity, no wheel ruts, footprints, or other irregularities shall exist in the subgrade. Furthermore, all protrusions extending more than one-half inch from the surface shall either be removed, crushed, or pushed into the surface with a smooth-drum compactor.

C. On a continuing basis, the project CQA inspector shall certify acceptance of the subgrade before GCL placement.

D. It shall be the Installer's responsibility thereafter to indicate to the Engineer any change in the condition of the subgrade that could cause the subgrade to be out of compliance with any of the requirements listed in this Section.

E. The GCL shall be anchored in accordance with the project plans.

3.4 GCL Placement

A. GCL shall be placed where indicated on the project drawings.

B. GCL rolls should be delivered to the working area of the site in their original packaging. Immediately prior to deployment, the packaging should be carefully removed without damaging the GCL. The orientation of the GCL (i.e., which side faces up) should be in accordance with the Engineer's or Manufacturer's recommendations. Unless otherwise specified, however, the GCL shall be installed such that the product name printed on one side of the GCL faces up.

C. Equipment which could damage the GCL shall not be allowed to travel directly on it. If the installation equipment causes rutting of the subgrade, the subgrade must be restored to its originally accepted condition before placement continues.

D. Care must be taken to minimize the extent to which the GCL is dragged across the subgrade in order to avoid damage to the bottom surface of the GCL. A temporary geosynthetic subgrade covering commonly known as a slip sheet or rub sheet may be used to reduce friction damage during placement.

E. The GCL shall be placed so that seams are perpendicular to the direction of the slope. Seams should be located at least 3 feet from the toe and crest of slopes steeper than 4H:1V. Upslope panels shall overlay downslope panels.

F. All GCL panels should lie flat on the underlying surface, with no wrinkles or fold, especially at the exposed edges of the panels.

G. Only as much GCL shall be deployed as can be covered at the end of the working day with soil, or a temporary waterproof tarpaulin. The GCL shall not be left uncovered overnight. If the GCL is hydrated when no confining stress is present, it may be necessary to remove and replace the hydrated material. The project Engineer, CQA inspector, and GCL supplier should be consulted for specific guidance if premature hydration occurs.

3.5 Seaming

A. The GCL seams are constructed by overlapping their adjacent edges. Care should be taken to ensure that the overlap zone is not contaminated with loose soil or other debris.

B. The minimum dimension of the longitudinal overlap should be 6 inches. End-of-roll overlapped seams should be similarly constructed, but the minimum overlap should measure 12 inches.

C. Seams at the ends of the panels should be constructed such that they are shingled in the direction of the grade to prevent the potential for runoff flow to enter the overlap zone.

3.6 Detail Work

A. The GCL shall be sealed around penetrations and embedded structures in accordance with the design drawings and the GCL Manufacturer.

B. Cutting the GCL should be performed using a sharp utility knife. Frequent blade changes are recommended to avoid damage to the geotextile components of the GCL during the cutting process.

3.7 Damage Repair

A. If the GCL is damaged (torn, punctured, perforated, etc.) during installation, it may be possible to repair it by cutting a parch to fit over the damaged area. The patch shall be obtained from a new GCL roll and shall be cut to size such that a minimum overlap of 12 inches is achieved around all the damaged area.

Section 02930
Seeding and Mulching

Part 1 - General

1.1 Scope

This section describes the services for final grading, seeding, fertilizing, mulching, and miscellaneous work required to complete revegetation of disturbed areas as specified herein.

1.2 Related Work

A. Division 1 sections of these Specifications.

B. Division 2 sections of these Specifications.

1.3 Implementation

Revegetate the areas disturbed by the soil remediation activities no later than 3 days after backfilling activities have been completed.

1.4 Quality Assurance

All seed and fertilizer shall be checked prior to seeding operations. No seeding shall be performed without inspection by the Construction Inspector. The Construction Inspector shall be notified at least 24 hours in advance of seeding operations.

1.5 Submittals

Certification of seed mixture, purity, germinating value, and crop year identification.

Part 2 - Products

2.1 Seed

Seed mixture will be as follows:

Species	Variety	Percent of Mix	Pounds PLS[1]/Acre (Drilled Planting)
Western wheatgrass	Arriba	40	6.4
Blue grama	Lovington	25	0.9
Sideoats grama	Vaughn	15	1.4
Buffalograss	Native	10	1.7
Little bluestem	Pastura	10	0.7
Total		100	11.1

[1]PLS = Pure Live Seed, a reflection of the amount of viable seed of specified species. (In a bag of bulk seed, % PLS = % Purity x % Germination/100).

2.2 Fertilizer

A. Fertilizer shall be uniform in composition, free flowing, and delivered to the site fully labeled according to applicable state laws and shall bear the name, trade name, or trademark and warranty of the producer.

B. The contractor may submit soil samples to the Colorado State Department of Agriculture laboratory for fertilizer recommendations. Recommendations shall be submitted to the Construction Inspector for approval prior to implementation.

C. Fertilize using 10-20-10 or equivalent at the rate of 600 pounds per acre or 15 pounds per 1,000 square feet.

2.3 Mulch

Mulch shall be long-stemmed, weed and seed-free grass hay. Cereal straw (wheat, barley, and oats) may be used as an alternative.

Part 3 - Execution

3.1 Seeding

A. Upon completion of finish grading, the soil surface shall be examined visually for organic content and water retention capability by the Construction Inspector.

B. Where directed by the Construction Inspector, stones and debris over 6 inches or which would interfere with maintenance shall be removed from the soil. An evenly finished surface shall be provided.

C. Apply lime and fertilizer at the rates specified in Section 2.2 of these Specifications.

D. Apply seed using a grass (or rangeland) drill with 7- to 12-inch row spacing equipped with separate seed boxes to facilitate the planting of large and small seed simultaneously, seed box agitators, double disk furrow openers, depth bands on each disk, and packer wheels or drag chains.

E. Drilling speed is limited to 4 to 4.5 miles per hour

3.2 Mulching

A. Immediately after seeding, apply mulch at a rate of 1.5 to 2.0 tons per acre.

B. Anchor mulch using a crimping machine to a depth of approximately 4 inches.

Section 01010
Summary of the Work

Part 1 - General

1.1 Description of the Project

A. Site Description

Denver Radium Site Operable Unit VIII is located in southwest Denver, northeast of the intersection of Evans Avenue and Santa Fe Drive. The site includes the 5.9 acres on which The S. W. Shattuck Chemical Company, Inc. (Shattuck) mineral processing facility was located.

B. Project Description

The Work for this project involves the Phase II construction activities including Excavation and Stabilization/Solidification (S/S) for the Denver Radium Site Operable Unit VIII. Phase II Work generally consists of the excavation of above-action-level and below-action-level soil from the Bannock Street Site and the S/S processing of above-action-level soil and crushed rubble to create a monolith on site.

The above-action-level soil will be treated by the S/S process. Below-action-level soil will be used in the construction and grading of the monolith foundation, and for general site grading.

The scope of work includes all labor, equipment, tools, materials, and services needed to accomplish all excavation, processing, placement of stabilized/solidified soils, construction of a cover system, and general cover as well as any incidental work as described herein or shown on the Drawings necessary to properly complete the Work.

1.2 Related Work

A. Division 1 sections of these Specifications.

B. Division 2 sections of these Specifications.

1.3 Definitions

A. "Above-Action-Level Soil" - Soils with concentrations of constituents of concern above those specified in Table 9-2 of the Record of Decision (ROD), except as modified by the U.S. Environmental Protection Agency (USEPA) letter to the Colorado Department of Public Health and Environment (CDPHE) dated January 16, 1992 which modified the generic protocol for excavation of Thorium-230.

B. "Below-Action-Level Soil" - Soils with concentrations of constituents of concern below those specified in Table 9-2 of the ROD, except as modified by the USEPA letter to the CDPHE dated January 16, 1992 which modified the generic protocol for excavation of Thorium-230.

C. "Cement" - A dry powder made from silica, alumina, lime, iron oxide, and magnesia used in the S/S process.

D. "Common Fill" - Imported clean fill suitable for use where indicated in the plans and specifications from an approved off-site location.

E. "Crushed Rubble" - Rubble resulting from crushing of stone and/or concrete slabs, bricks, and block from buildings and structures from vicinity properties and the Bannock Street Site.

F. "Excavation" - Removal of material to reach the lines, grades, and elevations shown on the drawings or as determined by above-action-level excavation control, verification or confirmation sampling.

G. "Excavation Confirmation Sample" - Above-action-level soil excavation verification sample to be confirmed through off-site laboratory analysis.

H. "Excavation Control Sample" - A sample collected for opposed crystal system (OCS) analysis to assist in delineating the extent of excavation.

I. Excavation "Verification Sample" - Composite sample used to determine limit of above-action-level soil excavation.

J. "Feedstock Material" - Above-action-level soil and crushed rubble prepared for S/S processing.

K. "Fly Ash" - Noncombustible fine particulate refuse from an approved supplier used in the S/S process.

L. "Lift" - A uniform layer of material placed in accordance with these Specifications.

M. "Percent Maximum Density" - A percentage of the maximum density at optimum moisture content obtained by specified American Society for Testing and Materials (ASTM) density testing methods.

N. "Perimeter Air Monitoring Program" - Plan for air monitoring along the perimeter of the Bannock Street Site utilizing air monitoring stations for collection of high-volume air samples. The plan is presented in the current Phase II Air Monitoring Plan.

O. "Personal Air Samples" - Personal air samples collected from personnel who may be potentially exposed to respiratory hazards during Phase II activities.

P. "Preplacement Material Sampling" - Samples of the processed S/S materials collected prior to placement.

Q. "Preprocessing Material Samples" - Samples of the prepared feedstock material collected prior to the S/S processing.

R. "Process Water" - Water used in the S/S process that meets the requirement of ASTM C 94.

S. "Radiological Surveys" - Surveys performed to evaluate the presence of radioactivity and/or radionuclides.

T. "Recompacted Soil/Clay Layer" (RSCL) - The natural barrier with a maximum permeability of 1×10^{-7} centimeter per second which serves as the barrier between the top of the monolith and the geosynthetic clay liner.

U. "Soils" - Unconsolidated material found above bedrock including, but not limited to, gravel, sand, silt, and clay. Vegetation such as sod is not considered soil and is removed prior to collection of samples.

V. "Subgrade Preparation" - Fine grading and compaction of existing ground or placed backfill upon which S/S-processed materials shall be placed.

W. "Unsatisfactory Fill Materials" - Soils unsatisfactory for fills including, but not limited to, materials containing organic matter, trash, debris, frozen materials, materials containing radioactivity or other hazardous contaminants in excess of ROD and/or regulatory standards, and materials which do not meet the requirements of Division 2. Materials which are unsatisfactory due to excessive or insufficient moisture or gradation may be used if screening, manipulation, aerating, watering, or preparing with other suitable materials results in acceptable properties.

X. Vicinity Properties - Properties in the vicinity of the Bannock Street Site remediated under Phase I activities.

Part 2 - Products

Not used.

Part 3 - Execution

3.1 Scope of Work

The Work for this project includes furnishing all labor, tools, equipment, materials, transportation, services, and incidentals, and performing all operations necessary for the Work as shown and noted on the Drawings and as required in these Specifications. The Work for this project includes, but is not limited to, the following:

A. Excavation of above-action-level soil for S/S processing. Excavation of below-action-level soil and/or backfill of below-action-level soil/common fill to achieve the base elevation of the monolith in an area of sufficient size to hold all S/S materials.

B. Implementation of materials sequencing and handling to allow for segregation and preparation of above-action-level soil. Below-action-level soil shall be segregated from above-action-level soil.

C. Stockpiles shall be covered to prevent erosion due to wind and water.

D. S/S processing of the excavated above-action-level soil. S/S shall be performed on excavated above-action-level soil as well as crushed rubble from the Bannock Street Site and Vicinity Properties.

E. Placement of the S/S-processed material in a monolith.

F. Construction of a cover system for the monolith consisting of, an RSCL, a GCL, a filter drainage layer, and riprap.

G. Construction and vegetation of a general cover for the remainder of the site consisting of below-action-level soil and/or common fill.

3.2 Construction Sequence

Except as specifically noted, the construction sequence described below is intended as guidance for this project. To the extent practicable, multiple tasks may be done simultaneously.

A. Mobilization

Mobilize as detailed in the current Phase II Mobilization Plan.

B. Soil Excavation

1. Excavate above-action-level soil until Opposed Crystal System (OCS) gamma radiation counter and shielded gamma scintillometer measurements indicate complete removal of above-action-level soil. Excavation is not complete until the confirmation from an off-site laboratory shows that all above-action-level soil has been removed.

2. If necessary, excavate below-action-level soil as required to achieve plan grades.

C. Foundation Preparation

In areas where above-action-level soil is excavated below the elevation of the monolith foundation, the area shall be backfilled with below-action-level soil or common fill and compacted for preparation of the monolith foundation. In areas where below-action-level soil is excavated to achieve monolith foundation grades, the monolith foundation shall be compacted and prepared as required by the appropriate specifications.

D. S/S and Monolith Construction

1. Above-action-level soil and crushed rubble shall be processed in accordance with Section 02210 of these Specifications.

2. Stabilized/solidified materials shall be placed into a monolith in accordance with Section 02215 of these Specifications.

E. Cover System and General Cover Construction

1. The completed monolith shall be covered with the following:

   a. Top: a 6-inch-thick RSCL, a GCL, an 18-inch-thick filter drainage layer, and an 18-inch-thick riprap layer.

   b. Sideslopes: an 18-inch-thick RSCL, a 12-inch-thick filter drainage layer, and an 18-inch-thick riprap layer

2. The remainder of the site shall be covered with below-action-level soil/common fill.

3.3 Work Quality Assurance (QA)

A. Shop and fieldwork shall be performed by personnel trained and experienced in field construction techniques. Work on this project shall be performed in accordance with the standard industry practices for the various construction trades involved.

B. Work shall be erected and installed plumb, level, and square and true, or true to indicated angle(s), and in proper alignment and relationship.

C. A qualified Construction Inspector shall review all construction activities conducted under these Specifications.

D. All QA Work shall conform to the requirements set forth in the Construction Quality Assurance Plan (CQAP) and the Quality Assurance Project Plan (QAPP).

Section 01020
Health and Safety

Part 1 - General

1.1 Scope

A. This section describes the project health and safety requirements, equipment, and personnel decontamination requirements, and procedures which will be required to be used during Phase II. Contractors and Subcontractors may conduct activities under their own health and safety plans provided such plans are no less protective of worker health and safety than the requirements set forth in these Specifications. A designated Health and Safety Officer and the Site Supervisor shall determine the adequacy of any Contractor's or Subcontractor's health and safety plans prior to their use at the Bannock Street Site.

B. Related Work

1. Division 1 sections of these Specifications.

2. Division 2 sections of these Specifications.

Part 2 - Products

Not used.

Part 3 - Execution

3.1 Phase II - Site Safety Compliance

Project management activities associated with health and safety shall be conducted in accordance with this Specification and the Phase II Site Safety Plan (SSP). Task description and hazard evaluation details are provided in Chapter 3.0 of the Phase II - SSP.

3.2 Personnel Safety and Training

A. Personnel Safety

All necessary safeguards shall be taken to ensure the safety of workers during the remedial action (RA). These shall include, but not be limited to, the following:

1. Workers shall not be permitted underneath loads handled by lifting or digging equipment. Personnel are required to stand away from any vehicles being loaded or unloaded to avoid being struck by any spillage or falling materials.

Final Cover System Elevation Report

Monolith Grade	Clay #	Clay Elevation	Clay vs. Monolith	Sand #	Sand Elevation	Sand vs. Clay	Gravel	Gravel Elevation	Gravel vs. Sand	Rip Rap #	Rip Rap Elevation	Rip Rap vs. Gravel	Total Thickness	Description
5265.6	**2003**	5267.1	1.5	**3003**	5267.6	0.5	**6003**	5268.1	0.5	**8003**	5269.6	1.5	4.0	**DITCH**
5275.5	**2005**	5277.1	1.6	**3005**	5278.1	1.0	**6005**	5278.6	0.5	**8005**	5280.1	1.5	4.6	**TOP - EDGE**
5265.4	**2006**	5266.9	1.5	**3006**	5267.4	0.5	**6006**	5267.9	0.5	**8006**	5269.4	1.5	4.0	**DITCH**
5275.4	**2008**	5277.1	1.7	**3008**	5278.1	1.0	**6008**	5278.6	0.5	**8008**	5280.1	1.5	4.7	**TOP - EDGE**
5264.9	**2009**	5266.4	1.5	**3009**	5266.9	0.5	**6009**	5267.4	0.5	**8009**	5268.9	1.5	4.0	**DITCH**
5267.1	**2010**	5268.6	1.5	**3010**	5269.1	0.5	**6010**	5269.6	0.5	**8010**	5271.1	1.5	4.0	**EAST**
5275.3	**2011**	5276.9	1.6	**3011**	5277.9	1.0	**6011**	5278.6	0.7	**8011**	5280.2	1.6	4.9	**TOP - EDGE**
5264.4	**2012**	5265.9	1.5	**3012**	5266.4	0.5	**6012**	5266.9	0.5	**8012**	5268.4	1.5	4.0	**DITCH**
5275.5	**2014**	5277.2	1.7	**3014**	5278.2	1.0	**6014**	5278.7	0.5	**8014**	5280.2	1.5	4.7	**TOP - EDGE**
5263.9	**2015**	5265.4	1.5	**3015**	5265.9	0.5	**6015**	5266.4	0.5	**8015**	5267.9	1.5	4.0	**DITCH**
5265.8	**2016**	5267.7	1.9	**3016**	5268.2	0.5	**6016**	5268.7	0.5	**8016**	5270.2	1.5	4.4	**EAST**
5275.1	**2017**	5276.9	1.8	**3017**	5277.9	1.0	**6017**	5278.5	0.6	**8017**	5280.1	1.6	5.0	**TOP - EDGE**
5263.4	**2018**	5264.9	1.5	**3018**	5265.4	0.5	**6018**	5265.9	0.5	**8018**	5267.4	1.5	4.0	**DITCH**
5274.7	**2021**	5276.5	1.8	**3021**	5277.5	1.0	**6021**	5278.0	0.5	**8021**	5279.5	1.5	4.8	**TOP - EDGE**
5262.9	**2022**	5264.4	1.5	**3022**	5264.9	0.5	**6022**	5265.4	0.5	**8022**	5266.9	1.5	4.0	**DITCH**
5265.4	**2023**	5267.2	1.8	**3023**	5267.7	0.5	**6023**	5268.2	0.5	**8023**	5269.7	1.5	4.3	**EAST**
5270.0	**2024**	5271.6	1.6	**3024**	5272.1	0.5	**6024**	5272.6	0.5	**8024**	5274.1	1.5	4.1	**EAST**
5272.5	**2025**	5274.8	2.3	**3025**	5275.3	0.5	**6025**	5275.8	0.5	**8025**	5277.3	1.5	4.8	**EAST**
5274.4	**2026**	5276.1	1.7	**3026**	5277.1	1.0	**6026**	5277.6	0.5	**8026**	5279.1	1.5	4.7	**TOP - EDGE**
5262.4	**2027**	5263.9	1.5	**3027**	5264.4	0.5	**6027**	5264.9	0.5	**8027**	5266.4	1.5	4.0	**DITCH**
5262.0	**2032**	5263.5	1.5	**3032**	5264.0	0.5	**6032**	5264.5	0.5	**8032**	5266.0	1.5	4.0	**DITCH**
5264.7	**2033**	5266.3	1.6	**3033**	5266.8	0.5	**6033**	5267.3	0.5	**8033**	5268.8	1.5	4.1	**EAST**
5270.0	**2034**	5271.5	1.5	**3034**	5272.0	0.5	**6034**	5272.6	0.6	**8034**	5274.6	2.0	4.6	**EAST**
5271.5	**2035**	5273.0	1.5	**3035**	5274.4	1.4	**6035**	5274.9	0.5	**8035**	5276.8	1.9	5.3	**EAST**
5273.0	**2036**	5275.2	2.2	**3036**	5276.2	1.0	**6036**	5276.7	0.5	**8036**	5278.2	1.5	5.2	**TOP - EDGE**
5261.5	**2037**	5263.0	1.5	**3037**	5263.5	0.5	**6037**	5264.0	0.5	**8037**	5265.5	1.5	4.0	**DITCH**
5273.0	**2041**	5274.9	1.9	**3041**	5275.9	1.0	**6041**	5276.4	0.5	**8041**	5277.9	1.5	4.9	**TOP - EDGE**
5261.0	**2042**	5262.5	1.5	**3042**	5263.0	0.5	**6042**	5263.5	0.5	**8042**	5265.0	1.5	4.0	**DITCH**
5264.4	**2043**	5265.9	1.5	**3043**	5266.4	0.5	**6043**	5266.9	0.5	**8043**	5268.4	1.5	4.0	**EAST**
5268.0	**2044**	5269.8	1.8	**3044**	5270.3	0.5	**6044**	5270.8	0.5	**8044**	5273.0	2.2	5.0	**EAST**
5270.0	**2045**	5272.3	2.3	**3045**	5272.8	0.5	**6045**	5273.3	0.5	**8045**	5274.8	1.5	4.8	**EAST**
5273.0	**2046**	5274.8	1.8	**3046**	5275.8	1.0	**6046**	5276.3	0.5	**8046**	5277.8	1.5	4.8	**TOP - EDGE**
5260.5	**2047**	5262.0	1.5	**3047**	5262.5	0.5	**6047**	5263.0	0.5	**8047**	5264.5	1.5	4.0	**DITCH**
5260.0	**2051**	5261.5	1.5	**3051**	5262.0	0.5	**6051**	5262.5	0.5	**8051**	5264.0	1.5	4.0	**DITCH**
5263.6	**2052**	5265.1	1.5	**3052**	5265.6	0.5	**6052**	5266.3	0.7	**8052**	5267.8	1.5	4.2	**EAST**
5266.0	**2053**	5268.0	2.0	**3053**	5268.5	0.5	**6053**	5269.1	0.6	**8053**	5271.2	2.1	5.2	**EAST**
5272.0	**2054**	5273.6	1.6	**3054**	5274.6	1.0	**6054**	5275.1	0.5	**8054**	5276.6	1.5	4.6	**TOP - EDGE**
5259.9	**2055**	5261.4	1.5	**3055**	5261.9	0.5	**6055**	5262.4	0.5	**8055**	5263.9	1.5	4.0	**DITCH**
5272.0	**2058**	5273.5	1.5	**3058**	5274.5	1.0	**6058**	5275.0	0.5	**8058**	5276.5	1.5	4.5	**TOP - EDGE**
5259.8	**2059**	5261.3	1.5	**3059**	5261.8	0.5	**6059**	5262.3	0.5	**8059**	5263.8	1.5	4.0	**DITCH**
5263.2	**2060**	5264.7	1.5	**3060**	5265.2	0.5	**6060**	5265.8	0.6	**8060**	5267.7	1.9	4.5	**EAST**
5271.0	**2061**	5273.0	2.0	**3061**	5274.0	1.0	**6061**	5274.5	0.5	**8061**	5276.0	1.5	5.0	**TOP - EDGE**
5271.0	**2062**	5273.6	2.6	**3062**	5274.6	1.0	**6062**	5275.1	0.5	**8062**	5276.6	1.5	5.6	**TOP**
5259.7	**2063**	5261.2	1.5	**3063**	5261.7	0.5	**6063**	5262.2	0.5	**8063**	5263.7	1.5	4.0	**DITCH**

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Monolith Grade	Clay #	Clay Elevation	Clay vs. Monolith	Sand #	Sand Elevation	Sand vs. Clay	Gravel	Gravel Elevation	Gravel vs. Sand	Rip Rap #	Rip Rap Elevation	Rip Rap vs. Gravel	Total Thickness	Description
5271.0	2065	5273.1	2.1	3065	5274.1	1.0	6065	5274.6	0.5	8065	5276.1	1.5	5.1	TOP - EDGE
5259.6	2066	5261.1	1.5	3066	5261.6	0.5	6066	5262.1	0.5	8066	5263.6	1.5	4.0	DITCH
5270.9	2068	5272.4	1.5	3068	5273.4	1.0	6068	5273.9	0.5	8068	5275.4	1.5	4.5	TOP - EDGE
5259.4	2069	5260.9	1.5	3069	5261.4	0.5	6069	5261.9	0.5	8069	5263.4	1.5	4.0	DITCH
5263.4	2070	5264.9	1.5	3070	5265.4	0.5	6070	5265.9	0.5	8070	5267.4	1.5	4.0	EAST
5259.3	2072	5260.8	1.5	3072	5261.3	0.5	6072	5261.8	0.5	8072	5263.3	1.5	4.0	DITCH
5270.0	2074	5271.6	1.6	3074	5272.6	1.0	6074	5273.1	0.5	8074	5274.8	1.7	4.8	TOP - EDGE
5259.2	2075	5260.7	1.5	3075	5261.2	0.5	6075	5261.7	0.5	8075	5263.2	1.5	4.0	DITCH
5262.2	2076	5263.7	1.5	3076	5264.2	0.5	6076	5264.9	0.7	8076	5266.4	1.5	4.2	EAST
5265.0	2077	5266.5	1.5	3077	5267.0	0.5	6077	5267.9	0.9	8077	5269.4	1.5	4.4	EAST
5270.0	2078	5271.7	1.7	3078	5272.7	1.0	6078	5273.2	0.5	8078	5274.7	1.5	4.7	TOP - EDGE
5264.8	2082	5266.3	1.5	3082	5266.8	0.5	6082	5267.3	0.5	8082	5268.8	1.5	4.0	DITCH
5267.8	2083	5269.3	1.5	3083	5269.8	0.5	6083	5270.3	0.5	8083	5272.2	1.9	4.4	SOUTH
5270.0	2084	5271.6	1.6	3084	5272.1	0.5	6084	5272.6	0.5	8084	5274.5	1.9	4.5	SOUTH
5273.3	2085	5275.7	2.4	3085	5276.2	0.5	6085	5276.7	0.5	8085	5278.2	1.5	4.9	SOUTH
5264.6	2086	5266.1	1.5	3086	5266.6	0.5	6086	5267.1	0.5	8086	5269.0	1.9	4.4	DITCH
5267.1	2087	5268.6	1.5	3087	5269.1	0.5	6087	5269.6	0.5	8087	5271.4	1.8	4.3	SOUTH
5274.0	2088	5275.6	1.6	3088	5276.6	1.0	6088	5277.1	0.5	8088	5278.6	1.5	4.6	TOP - EDGE
5264.3	2089	5265.8	1.5	3089	5266.3	0.5	6089	5266.8	0.5	8089	5268.3	1.5	4.0	DITCH
5266.5	2090	5268.4	1.9	3090	5268.9	0.5	6090	5269.4	0.5	8090	5270.9	1.5	4.4	SOUTH
5272.0	2091	5273.5	1.5	3091	5274.0	0.5	6091	5274.5	0.5	8091	5276.3	1.8	4.3	SOUTH
5274.0	2092	5276.0	2.0	3092	5277.0	1.0	6092	5277.5	0.5	8092	5279.0	1.5	5.0	TOP - EDGE
5264.1	2093	5265.6	1.5	3093	5266.1	0.5	6093	5266.6	0.5	8093	5268.1	1.5	4.0	DITCH
5266.2	2094	5267.7	1.5	3094	5268.3	0.6	6094	5268.8	0.5	8094	5270.3	1.5	4.1	SOUTH
5274.0	2095	5276.0	2.0	3095	5277.0	1.0	6095	5277.5	0.5	8095	5279.0	1.5	5.0	TOP - EDGE
5263.9	2096	5265.4	1.5	3096	5265.9	0.5	6096	5266.4	0.5	8096	5267.9	1.5	4.0	DITCH
5274.0	2099	5275.6	1.6	3099	5276.6	1.0	6099	5277.1	0.5	8099	5278.6	1.5	4.6	TOP - EDGE
5263.6	2100	5265.1	1.5	3100	5265.6	0.5	6100	5266.1	0.5	8100	5267.6	1.5	4.0	DITCH
5265.8	2101	5267.3	1.5	3101	5268.3	1.0	6101	5268.8	0.5	8101	5270.3	1.5	4.5	SOUTH
5273.9	2102	5275.4	1.5	3102	5276.4	1.0	6102	5276.9	0.5	8102	5278.4	1.5	4.5	TOP - EDGE
5263.4	2103	5264.9	1.5	3103	5265.4	0.5	6103	5265.9	0.5	8103	5267.4	1.5	4.0	DITCH
5273.9	2105	5275.4	1.5	3105	5276.4	1.0	6105	5276.9	0.5	8105	5278.6	1.7	4.7	TOP - EDGE
5263.1	2106	5264.6	1.5	3106	5265.1	0.5	6106	5265.6	0.5	8106	5267.1	1.5	4.0	DITCH
5265.5	2107	5267.4	1.9	3107	5268.4	1.0	6107	5268.9	0.5	8107	5270.4	1.5	4.9	SOUTH
5274.0	2108	5276.0	2.0	3108	5277.0	1.0	6108	5277.5	0.5	8108	5279.3	1.8	5.3	TOP - EDGE
5261.4	2109	5262.9	1.5	3109	5263.4	0.5	6109	5263.9	0.5	8109	5265.4	1.5	4.0	DITCH
5263.4	2110	5265.1	1.7	3110	5265.6	0.5	6110	5266.1	0.5	8110	5267.6	1.5	4.2	WEST
5270.0	2111	5272.9	2.9	3111	5273.4	0.5	6111	5273.9	0.5	8111	5275.8	1.9	5.8	WEST
5275.0	2112	5276.7	1.7	3112	5277.7	1.0	6112	5278.2	0.5	8112	5280.0	1.8	5.0	TOP - EDGE
5261.2	2113	5262.7	1.5	3113	5263.2	0.5	6113	5263.7	0.5	8113	5265.2	1.5	4.0	DITCH
5275.0	2115	5276.6	1.6	3115	5277.6	1.0	6115	5278.1	0.5	8115	5279.6	1.5	4.6	TOP - EDGE
5261.0	2116	5262.5	1.5	3116	5263.0	0.5	6116	5263.5	0.5	8116	5265.0	1.5	4.0	DITCH
5260.7	2119	5262.2	1.5	3119	5262.7	0.5	6119	5263.2	0.5	8119	5264.7	1.5	4.0	DITCH
5261.9	2120	5264.3	2.4	3120	5264.8	0.5	6120	5265.3	0.5	8120	5266.8	1.5	4.9	WEST

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Monolith Grade	Clay #	Clay Elevation	Clay vs. Monolith	Sand #	Sand Elevation	Sand vs. Clay	Gravel	Gravel Elevation	Gravel vs. Sand	Rip Rap #	Rip Rap Elevation	Rip Rap vs. Gravel	Total Thickness	Description
5274.0	2121	5275.6	1.6	3121	5276.6	1.0	6121	5277.1	0.5	8121	5278.6	1.5	4.6	TOP - EDGE
5260.5	2122	5262.0	1.5	3122	5262.5	0.5	6122	5263.0	0.5	8122	5264.5	1.5	4.0	DITCH
5269.0	2124	5270.5	1.5	3124	5271.0	0.5	6124	5272.1	1.1	8124	5273.6	1.5	4.6	WEST
5260.4	2126	5261.9	1.5	3126	5262.4	0.5	6126	5262.9	0.5	8126	5264.4	1.5	4.0	DITCH
5268.9	2128	5270.4	1.5	3128	5271.4	1.0	6128	5271.9	0.5	8128	5273.5	1.6	4.6	WEST
5272.8	2129	5274.5	1.7	3129	5275.0	0.5	6129	5276.0	1.0	8129	5277.5	1.5	4.7	WEST
5260.2	2131	5261.7	1.5	3131	5262.2	0.5	6131	5262.7	0.5	8131	5264.2	1.5	4.0	DITCH
5261.7	2132	5263.2	1.5	3132	5263.7	0.5	6132	5264.2	0.5	8132	5265.9	1.7	4.2	WEST
5266.0	2133	5268.1	2.1	3133	5268.6	0.5	6133	5269.1	0.5	8133	5270.9	1.8	4.9	WEST
5273.0	2134	5274.6	1.6	3134	5275.6	1.0	6134	5276.1	0.5	8134	5277.6	1.5	4.6	TOP - EDGE
5260.1	2135	5261.6	1.5	3135	5262.1	0.5	6135	5262.6	0.5	8135	5264.1	1.5	4.0	DITCH
5261.8	2136	5263.3	1.5	3136	5263.8	0.5	6136	5264.3	0.5	8136	5266.0	1.7	4.2	WEST
5266.3	2137	5267.9	1.6	3137	5268.4	0.5	6137	5268.9	0.5	8137	5270.8	1.9	4.5	WEST
5273.0	2138	5274.7	1.7	3138	5275.7	1.0	6138	5276.3	0.6	8138	5278.1	1.8	5.1	TOP - EDGE
5259.9	2139	5261.4	1.5	3139	5261.9	0.5	6139	5262.4	0.5	8139	5263.9	1.5	4.0	DITCH
5259.8	2144	5261.3	1.5	3144	5261.8	0.5	6144	5262.3	0.5	8144	5263.8	1.5	4.0	DITCH
5262.1	2145	5263.8	1.7	3145	5264.8	1.0	6145	5265.3	0.5	8145	5266.8	1.5	4.7	WEST
5266.2	2146	5267.8	1.6	3146	5268.8	1.0	6146	5269.3	0.5	8146	5270.8	1.5	4.6	WEST
5273.0	2147	5274.8	1.8	3147	5275.8	1.0	6147	5276.3	0.5	8147	5277.8	1.5	4.8	TOP - EDGE
5259.7	2148	5261.2	1.5	3148	5261.7	0.5	6148	5262.2	0.5	8148	5263.7	1.5	4.0	DITCH
5259.5	2152	5261.0	1.5	3152	5261.5	0.5	6152	5262.0	0.5	8152	5263.5	1.5	4.0	DITCH
5268.0	2155	5270.9	2.9	3155	5271.4	0.5	6155	5271.9	0.5	8155	5273.4	1.5	5.4	WEST
5272.0	2156	5273.9	1.9	3156	5274.9	1.0	6156	5275.4	0.5	8156	5276.9	1.5	4.9	WEST
5259.4	2157	5260.9	1.5	3157	5261.4	0.5	6157	5261.9	0.5	8157	5263.4	1.5	4.0	DITCH
5268.0	2160	5270.7	2.7	3160	5271.2	0.5	6160	5271.7	0.5	8160	5273.2	1.5	5.2	WEST
5272.0	2161	5273.5	1.5	3161	5274.0	0.5	6161	5274.5	0.5	8161	5276.0	1.5	4.0	WEST
5259.2	2162	5260.7	1.5	3162	5261.2	0.5	6162	5261.7	0.5	8162	5263.2	1.5	4.0	DITCH
5266.4	2164	5267.9	1.5	3164	5268.4	0.5	6164	5269.0	0.6	8164	5270.5	1.5	4.1	WEST
5267.8	2165	5270.2	2.4	3165	5270.7	0.5	6165	5271.2	0.5	8165	5272.7	1.5	4.9	WEST
5270.6	2166	5273.2	2.6	3166	5274.2	1.0	6166	5274.7	0.5	8166	5276.2	1.5	5.6	WEST
5259.1	2167	5260.6	1.5	3167	5261.1	0.5	6167	5261.6	0.5	8167	5263.1	1.5	4.0	DITCH
5265.0	2169	5266.9	1.9	3169	5267.9	1.0	6169	5268.9	1.0	8169	5270.4	1.5	5.4	WEST
5270.9	2170	5272.4	1.5	3170	5273.4	1.0	6170	5274.1	0.7	8170	5275.6	1.5	4.7	TOP - EDGE
5259.0	2171	5260.5	1.5	3171	5261.0	0.5	6171	5261.5	0.5	8171	5263.0	1.5	4.0	DITCH
5271.0	2173	5272.8	1.8	3173	5273.8	1.0	6173	5274.3	0.5	8173	5275.8	1.5	4.8	TOP - EDGE
5258.8	2174	5260.3	1.5	3174	5260.8	0.5	6174	5261.3	0.5	8174	5262.8	1.5	4.0	DITCH
5262.4	2175	5263.9	1.5	3175	5264.4	0.5	6175	5265.1	0.7	8175	5266.8	1.7	4.4	WEST
5271.0	2176	5272.8	1.8	3176	5273.8	1.0	6176	5274.3	0.5	8176	5275.8	1.5	4.8	TOP - EDGE
5258.7	2177	5260.2	1.5	3177	5260.7	0.5	6177	5261.2	0.5	8177	5262.7	1.5	4.0	DITCH
5258.5	2180	5260.0	1.5	3180	5260.5	0.5	6180	5261.0	0.5	8180	5262.5	1.5	4.0	DITCH
5262.3	2181	5264.3	2.0	3181	5264.8	0.5	6181	5265.3	0.5	8181	5266.8	1.5	4.5	WEST
5265.0	2182	5267.4	2.4	3182	5267.9	0.5	6182	5268.4	0.5	8182	5269.9	1.5	4.9	WEST
5270.0	2183	5271.6	1.6	3183	5272.6	1.0	6183	5273.1	0.5	8183	5274.6	1.5	4.6	TOP - EDGE

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Monolith Grade	Clay #	Clay Elevation	Clay vs. Monolith	Sand #	Sand Elevation	Sand vs. Clay	Gravel	Gravel Elevation	Gravel vs. Sand	Rip Rap #	Rip Rap Elevation	Rip Rap vs. Gravel	Total Thickness	Description
5258.4	2184	5259.9	1.5	3184	5260.4	0.5	6184	5260.9	0.5	8184	5262.4	1.5	4.0	DITCH
5263.7	2186	5266.0	2.3	3186	5266.5	0.5	6186	5267.3	0.8	8186	5268.8	1.5	5.1	WEST
5270.0	2187	5271.6	1.6	3187	5272.6	1.0	6187	5273.1	0.5	8187	5275.3	2.2	5.3	TOP - EDGE
No Mono	2188	5259.7	N/A	3188	5260.2	0.5	6188	5260.7	0.5	8188	5262.2	1.5	N/A	DITCH
5270.1	2189	5271.6	1.5	3189	5272.6	1.0	6189	5273.1	0.5	8189	5274.6	1.5	4.5	TOP - EDGE
No Mono	2190	5259.7	N/A	3190	5260.2	0.5	6190	5260.7	0.5	8190	5262.2	1.5	N/A	DITCH
No Mono	2192	5259.4	N/A	3192	5259.9	0.5	6192	5260.4	0.5	8192	5261.9	1.5	N/A	DITCH
No Mono	2193	5271.6	N/A	3193	5272.6	1.0	6193	5273.1	0.5	8193	5274.6	1.5	N/A	TOP - EDGE
No Mono	2194	5259.1	N/A	3194	5259.6	0.5	6194	5260.1	0.5	8194	5261.6	1.5	N/A	DITCH
5269.4	2195	5270.9	1.5	3195	5271.9	1.0	6195	5272.9	1.0	8195	5274.4	1.5	5.0	TOP - EDGE
No Mono	2196	5259.2	N/A	3196	5259.7	0.5	6196	5260.2	0.5	8196	5261.7	1.5	N/A	DITCH
5268.8	2197	5270.3	1.5	3197	5271.3	1.0	6197	5271.8	0.5	8197	5273.3	1.5	4.5	TOP - EDGE
No Mono	2198	5259.5	N/A	3198	5260.0	0.5	6198	5260.5	0.5	8198	5262.0	1.5	N/A	DITCH
5270.5	2199	5271.4	0.9	3199	5272.4	1.0	6199	5272.9	0.5	8199	5274.6	1.7	4.1	TOP
5276.6	2200	5277.2	0.6	3200	5278.2	1.0	6200	5278.9	0.7	8200	5280.5	1.6	3.9	TOP
5276.6	2201	5277.6	1.0	3201	5278.6	1.0	6201	5279.1	0.5	8201	5280.6	1.5	4.0	TOP
5276.5	2203	5278.0	1.5	3203	5279.5	1.5	6203	5280.0	0.5	8203	5281.5	1.5	5.0	TOP
5276.3	2205	5277.3	1.0	3205	5278.3	1.0	6205	5278.8	0.5	8205	5280.3	1.5	4.0	TOP
5277.1	2207	5277.7	0.6	3207	5278.7	1.0	6207	5279.2	0.5	8207	5280.7	1.5	3.6	TOP
5277.4	2210	5277.9	0.5	3210	5278.9	1.0	6210	5279.4	0.5	8210	5280.9	1.5	3.5	TOP
5276.3	2212	5277.2	0.9	3212	5278.2	1.0	6212	5278.7	0.5	8212	5280.2	1.5	3.9	TOP
5276.3	2213	5277.2	0.9	3213	5278.3	1.1	6213	5278.8	0.5	8213	5280.4	1.6	4.1	TOP
5276.4	2214	5277.4	1.0	3214	5278.4	1.0	6214	5278.9	0.5	8214	5280.4	1.5	4.0	TOP
5276.1	2215	5277.3	1.2	3215	5278.3	1.0	6215	5278.8	0.5	8215	5280.3	1.5	4.2	TOP
5275.4	2217	5276.3	0.9	3217	5277.3	1.0	6217	5277.8	0.5	8217	5279.3	1.5	3.9	TOP
5275.9	2218	5276.4	0.5	3218	5277.4	1.0	6218	5277.9	0.5	8218	5279.4	1.5	3.5	TOP
5274.3	2219	5275.8	1.5	3219	5276.8	1.0	6219	5277.3	0.5	8219	5278.8	1.5	4.5	TOP
5275.3	2220	5276.3	1.0	3220	5277.3	1.0	6220	5277.8	0.5	8220	5279.7	1.9	4.4	TOP
5275.3	2222	5276.3	1.1	3222	5277.3	1.0	6222	5277.8	0.5	8222	5279.3	1.5	4.1	TOP
5274.9	2223	5276.2	1.3	3223	5277.2	1.0	6223	5277.7	0.5	8223	5279.2	1.5	4.3	TOP
5274.4	2226	5275.5	1.1	3226	5276.5	1.0	6226	5277.0	0.5	8226	5278.5	1.5	4.1	TOP
5274.8	2227	5275.5	0.7	3227	5276.5	1.0	6227	5277.0	0.5	8227	5278.5	1.5	3.7	TOP
5274.8	2228	5275.7	0.9	3228	5276.7	1.0	6228	5277.2	0.5	8228	5278.7	1.5	3.9	TOP
5274.6	2229	5275.5	0.9	3229	5276.5	1.0	6229	5277.1	0.6	8229	5278.7	1.6	4.1	TOP
5274.2	2232	5275.0	0.8	3232	5276.0	1.0	6232	5276.5	0.5	8232	5278.0	1.5	3.8	TOP
5274.2	2233	5275.3	1.1	3233	5276.3	1.0	6233	5276.8	0.5	8233	5278.3	1.5	4.1	TOP
5274.0	2234	5275.0	1.0	3234	5276.0	1.0	6234	5276.5	0.5	8234	5278.0	1.5	4.0	TOP
5273.3	2235	5274.5	1.2	3235	5275.5	1.0	6235	5276.0	0.5	8235	5277.5	1.5	4.2	TOP
5274.1	2236	5274.8	0.8	3236	5275.8	1.0	6236	5276.3	0.5	8236	5277.8	1.5	3.8	TOP
5273.9	2237	5274.7	0.8	3237	5275.7	1.0	6237	5276.2	0.5	8237	5277.7	1.5	3.8	TOP
5273.5	2238	5274.0	0.5	3238	5275.0	1.0	6238	5275.5	0.5	8238	5277.0	1.5	3.5	TOP
5273.3	2240	5274.1	0.8	3240	5275.1	1.0	6240	5275.6	0.5	8240	5277.1	1.5	3.8	TOP
5273.4	2241	5274.0	0.6	3241	5275.0	1.0	6241	5275.5	0.5	8241	5277.0	1.5	3.6	TOP

Final Cover System Elevation Report

Monolith Grade	Clay #	Clay Elevation	Clay vs. Monolith	Sand #	Sand Elevation	Sand vs. Clay	Gravel	Gravel Elevation	Gravel vs. Sand	Rip Rap #	Rip Rap Elevation	Rip Rap vs. Gravel	Total Thickness	Description
5272.7	2243	5273.9	1.2	3243	5274.9	1.0	6243	5275.4	0.5	8243	5276.9	1.5	4.2	TOP
5272.4	2244	5273.6	1.2	3244	5274.6	1.0	6244	5275.1	0.5	8244	5276.9	1.8	4.5	TOP
5270.7	2247	5271.5	0.8	3247	5272.5	1.0	6247	5273.0	0.5	8247	5274.5	1.5	3.8	TOP
5271.8	2248	5272.6	0.8	3248	5273.6	1.0	6248	5274.1	0.5	8248	5275.6	1.5	3.8	TOP
5272.3	2249	5273.0	0.7	3249	5274.0	1.0	6249	5274.5	0.5	8249	5276.0	1.5	3.7	TOP
5272.1	2250	5272.8	0.8	3250	5273.8	1.0	6250	5274.3	0.5	8250	5275.8	1.5	3.8	TOP
5271.0	2254	5271.9	0.9	3254	5272.9	1.0	6254	5273.4	0.5	8254	5274.9	1.5	3.9	TOP
5271.2	2255	5272.3	1.1	3255	5273.3	1.0	6255	5273.8	0.5	8255	5275.3	1.5	4.1	TOP
5271.2	2256	5272.1	0.9	3256	5273.1	1.0	6256	5273.6	0.5	8256	5275.1	1.5	3.9	TOP
5270.6	2258	5271.1	0.5	3258	5272.1	1.0	6258	5272.6	0.5	8258	5274.1	1.5	3.5	TOP
5270.8	2259	5271.9	1.1	3259	5272.9	1.0	6259	5273.4	0.5	8259	5274.9	1.5	4.1	TOP
5270.8	2260	5272.0	1.2	3260	5273.0	1.0	6260	5273.5	0.5	8260	5275.0	1.5	4.2	TOP
5271.7	2263	5272.2	0.5	3263	5273.2	1.0	6263	5273.7	0.5	8263	5275.2	1.5	3.5	TOP
5271.5	2267	5272.1	0.6	3267	5273.1	1.0	6267	5273.6	0.5	8267	5275.6	2.0	4.1	TOP
5272.2	2273	5272.8	0.6	3273	5273.8	1.0	6273	5274.7	0.9	8273	5276.3	1.6	4.1	TOP
5272.9	2275	5273.7	0.8	3275	5274.8	1.1	6275	5275.3	0.5	8275	5276.9	1.6	4.0	TOP
5272.4	2276	5273.4	1.0	3276	5274.4	1.0	6276	5274.9	0.5	8276	5276.4	1.5	4.0	TOP
5271.9	2278	5272.9	1.0	3278	5273.9	1.0	6278	5274.5	0.6	8278	5276.5	2.0	4.6	TOP
5273.8	2280	5274.4	0.6	3280	5275.4	1.0	6280	5275.9	0.5	8280	5277.4	1.5	3.6	TOP
5272.4	2284	5273.3	0.9	3284	5274.3	1.0	6284	5274.8	0.5	8284	5276.3	1.5	3.9	TOP
5274.0	2285	5274.8	0.8	3285	5275.8	1.0	6285	5276.3	0.5	8285	5277.8	1.5	3.8	TOP
5273.8	2287	5274.3	0.5	3287	5275.3	1.0	6287	5275.8	0.5	8287	5277.3	1.5	3.5	TOP
5274.4	2296	5275.5	1.1	3296	5276.5	1.0	6296	5277.0	0.5	8296	5278.5	1.5	4.1	TOP
5274.3	2299	5275.8	1.5	3299	5276.8	1.0	6299	5277.3	0.5	8299	5278.8	1.5	4.5	TOP
5274.8	2300	5275.8	1.0	3300	5276.8	1.0	6300	5277.3	0.5	8300	5278.8	1.5	4.0	TOP
5274.6	2306	5275.6	1.0	3306	5276.6	1.0	6306	5277.1	0.5	8306	5278.6	1.5	4.0	TOP
5276.1	2310	5276.7	0.6	3310	5277.7	1.0	6310	5278.2	0.5	8310	5279.7	1.5	3.6	TOP
5275.1	2311	5276.4	1.3	3311	5277.4	1.0	6311	5277.9	0.5	8311	5279.4	1.5	4.3	TOP
5276.1	2320	5277.0	0.9	3320	5278.0	1.0	6320	5278.5	0.5	8320	5280.0	1.5	3.9	TOP
5275.9	2321	5277.0	1.1	3321	5278.0	1.0	6321	5278.5	0.5	8321	5280.0	1.5	4.1	TOP
5275.8	2325	5276.6	0.8	3325	5277.6	1.0	6325	5278.1	0.5	8325	5279.6	1.5	3.8	TOP
5275.9	2329	5277.4	1.5	3329	5278.4	1.0	6329	5278.9	0.5	8329	5280.4	1.5	4.5	TOP
5276.3	2330	5277.4	1.1	3330	5278.4	1.0	6330	5278.9	0.5	8330	5280.4	1.5	4.1	TOP
5276.3	2336	5277.2	0.9	3336	5278.4	1.2	6336	5278.9	0.5	8336	5280.4	1.5	4.1	TOP
5276.3	2337	5276.9	0.6	3337	5278.4	1.5	6337	5278.9	0.5	8337	5280.4	1.5	4.1	TOP
5276.6	2340	5277.1	0.5	3340	5278.1	1.0	6340	5278.6	0.5	8340	5280.1	1.5	3.5	TOP
5276.0	2343	5277.4	1.4	3343	5278.4	1.0	6343	5278.9	0.5	8343	5280.4	1.5	4.4	TOP
5276.2	2347	5277.5	1.3	3347	5278.5	1.0	6347	5279.0	0.5	8347	5280.5	1.5	4.3	TOP
5275.3	2349	5276.7	1.4	3349	5277.7	1.0	6349	5278.2	0.5	8349	5279.7	1.5	4.4	TOP
5275.6	2358	5276.4	0.8	3358	5277.4	1.0	6358	5277.9	0.5	8358	5279.4	1.5	3.8	TOP
5274.8	2359	5276.2	1.4	3359	5277.2	1.0	6359	5277.7	0.5	8359	5279.2	1.5	4.4	TOP
5268.0	2361	5269.5	1.5	3361	5270.0	0.5	6361	5270.6	0.6	8361	5272.1	1.5	4.1	EAST
5272.0	2365	5273.8	1.8	3365	5274.3	0.5	6365	5274.8	0.5	8365	5276.3	1.5	4.3	EAST

Final Cover System Elevation Report

Monolith Grade	Clay #	Clay Elevation	Clay vs. Monolith	Sand #	Sand Elevation	Sand vs. Clay	Gravel	Gravel Elevation	Gravel vs. Sand	Rip Rap #	Rip Rap Elevation	Rip Rap vs. Gravel	Total Thickness	Description
5273.5	**2367**	5275.5	2.0	**3367**	5276.0	0.5	**6367**	5276.5	0.5	**8367**	5278.0	1.5	4.5	**EAST**
5275.2	**2369**	5276.7	1.5	**3369**	5277.7	1.0	**6369**	5278.2	0.5	**8369**	5279.9	1.7	4.7	**TOP**
5274.2	**2370**	5275.7	1.5	**3370**	5276.2	0.5	**6370**	5276.7	0.5	**8370**	5278.8	2.1	4.6	**SOUTH**
5272.5	**2372**	5274.0	1.5	**3372**	5274.8	0.8	**6372**	5275.3	0.5	**8372**	5276.9	1.6	4.4	**SOUTH**
5270.5	**2374**	5272.7	2.2	**3374**	5273.2	0.5	**6374**	5273.7	0.5	**8374**	5275.2	1.5	4.7	**SOUTH**
5268.7	**2376**	5270.3	1.6	**3376**	5270.8	0.5	**6376**	5271.3	0.5	**8376**	5272.8	1.5	4.1	**SOUTH**
5265.4	**2378**	5267.4	2.0	**3378**	5267.9	0.5	**6378**	5268.4	0.5	**8378**	5269.9	1.5	4.5	**SOUTH**
5264.5	**2379**	5266.2	1.7	**3379**	5266.7	0.5	**6379**	5267.2	0.5	**8379**	5268.7	1.5	4.2	**SOUTH**
5266.1	**2381**	5267.6	1.5	**3381**	5268.1	0.5	**6381**	5268.6	0.5	**8381**	5270.1	1.5	4.0	**EAST**
No Mono	**2387**	5267.6	N/A	**3387**	5268.1	0.5	**6387**	5268.6	0.5	**8387**	5270.1	1.5	N/A	**DITCH**
No Mono	**2388**	5263.8	N/A	**3388**	5264.3	0.5	**6388**	5264.8	0.5	**8388**	5266.3	1.5	N/A	**DITCH**
No Mono	**2389**	5260.3	N/A	**3389**	5260.8	0.5	**6389**	5261.3	0.5	**8389**	5262.8	1.5	N/A	**DITCH**
No Mono	**2391**	5260.0	N/A	**3391**	5260.5	0.5	**6391**	5261.0	0.5	**8391**	5262.5	1.5	N/A	**DITCH**

Note: The survey layout identification number is the same as the "Clay # ".

SHATTUCK CHEMICAL
THE S. W. SHATTUCK CHEMICAL COMPANY, INC.

1805 S. Bannock St., Denver, Colo. 80223 / Phone (303) 744-1795 / Telex 45-874 / Cable 'Shattuck Denver'

September 17, 1998

VIA FACSIMILE

Ms. Rebecca J. Thomas
Remedial Project Manager
Environmental Protection Agency
Region VIII
One Denver Place, North Terrace
999 Eighteenth Street, Suite 600
Denver, Colorado 80202-2045

Re: Construction Pre-Certification Notice:
Operable Unit VIII of the Denver Radium Site

Dear Rebecca:

This letter is a Construction Pre-Certification Notice to the U.S. Environmental Protection Agency pursuant to the Unilateral Administrative Order for Remedial Design/Remedial Action issued to The S.W. Shattuck Chemical Company, Inc. dated August 21, 1992 (UAO). Shattuck believes that construction activities at Operable Unit VIII of the Denver Radium Site have been fully performed in accordance with the Record of Decision, Denver Radium Site, Operable Unit VIII dated January 28, 1992 and the Final Remedial Design.

Sincerely,

Robert H. Oliver

Robert H. Oliver
Project Manager

Attachment A
Denver Radium Sites Operable Unit VIII
The S.W. Shattuck Chemical Company Site
Remedial Action Construction
Pre-Final Inspection

A Pre-Final Inspection was held at the Bannock Street Site (the Site) at 2:00 P.M. on September 17, 1998 with representatives of the U.S. Environmental Protection Agency (EPA) and the Colorado Department of Public Health and the Environment (CDPHE). The following individuals were in attendance:

Individual	Organization
Rebecca Thomas	EPA
Jim Hanley	EPA
Larry Bruskin	CDPHE
Phil Stoffey	CDPHE
Sue Ford	Morrison Knudsen
Paul Rosasco	EMSI (for Shattuck)

A site walk was conducted around the perimeter of the monolith/ perimeter of the site and on the top of the monolith. The following items were identified by the Shattuck representative and/or the EPA/CDPHE representatives:

Remaining Construction Activities/Items

1. Two of the air sparge wells on the western boundary of the site were damaged during installation of the air sparge header pipe and will be replaced this week or early next week.

2. Protective casings or covers will be installed over the six soil vapor monitoring probes located along the line of air sparge wells.

3. Soundproofing material will be added to the air sparge building to dampen the noise from the blower system.

4. Additional gravel will be placed and graded on the site perimeter road to bring the road grade up above the base of the fence and to bring the road up to the grade of the protective covers over the air sparge wells.

5. A large indentation and one broken strand were identified in the perimeter fence apparently as a result of unrelated off-site construction activities. The damaged area is located in the westernmost portion of the southern perimeter fence. The observed

damage is only cosmetic and does not affect the integrity of the fence in limiting trespass on the site. The damaged portion of the fence will be repaired or replaced.

6. The vegetative cover on the north slope was observed to be sparse in areas and the vegetation contained weeds in some areas. Additional revegetation efforts will be conducted this fall.

Other items (non-remedial construction related) to be conducted

1. The Regional Transportation District will replace the western site perimeter fence when they complete construction activities on the adjacent property.

2. Upon receipt of EPA's approval of the Construction Completion Report, Shattuck will remove the guard shack and the portable toilet.

Questions were raised with regard to the presence of locks on the monolith monitoring wells. The wells are secured with a locking mechanism that requires a special tool to open. The protective casings over the wells are also bolted close.

A question was also raised with regard to the purpose of green paint at various locations on the rip-rap. These locations represent the radon flux measurement locations. These locations were painted to differentiate them from the gamma reading locations both of which were identified with surveying flags.

EPA intends to issue an Explanation of Significant Differences (ESD) with regard to certain applicable or relevant and appropriate requirements (ARARs) and the volume of above action soils treated at the site.

U.S. Environmental Protection Agency
Denver Radium Sites Operable Unit VIII

Notice of Final Completion Inspection

Date: 17 September 1998

Address: 1805 S. Bannock St.

Property Owner: S.W. Shattuck Chemical Company

Remedial action on the property at the location cited above is hereby certified by the undersigned as complete under the terms and conditions of the Record of Decision, the Unilateral Administrative Order dated 21 August 1992, the Statement of Work, and the approved Remedial Design and Action work plans.

Final/No Deficiencies ☐ ☐ Final/Deficiencies

Any minor deviations from the terms and conditions of the above referenced documents are described below and will be corrected within fourteen(14) calendar days unless an extension is requested and granted.

Deficiencies to be Corrected:

Signatories

Deficiencies to be corrected date:

8 Feb 99

US EPA Representatives Date

CDPHE Representatives Date

U.S. Environmental Protection Agency
Denver Radium Sites Operable Unit VIII

Notice of Final Completion Inspection

Date : September 17, 1998

Address : 1805 S. Bannock St.

Property Owner : S. W. Shattuck Chemical Company

Remedial action on the property at the location cited above is hereby certified by the undersigned as complete under the terms and conditions of the Record of Decision, the Unilateral Administrative Order dated August 21, 1992, the Statement of Work and approved Remedial Design and Work Plans.

☐ Final/No Deficiencies ☐ Final/Deficiencies

Any minor deviations from the terms and conditions of the above referenced documents are described below and will be corrected within fourteen (14) calender days unless an extension is requested and granted.

Deficiencies to be Corrected

See Attachment A

Signatories

Deficiencies To Be Corrected Date ____________________

____
US EPA Representative Date

Phil S Stoffey 2/8/99
CDPHE Representative Date

____
Construction Inspector Date

U.S. Environmental Protection Agency
Denver Radium Sites Operable Unit VIII

Notice of Final Completion Inspection

Date : September 17, 1998

Address : 1805 S. Bannock St.

Property Owner : S. W. Shattuck Chemical Company

Remedial action on the property at the location cited above is hereby certified by the undersigned as complete under the terms and conditions of the Record of Decision, the Unilateral Administrative Order dated August 21, 1992, the Statement of Work and approved Remedial Design and Work Plans.

☐ Final/No Deficiencies ☐ Final/Deficiencies

Any minor deviations from the terms and conditions of the above referenced documents are described below and will be corrected within fourteen (14) calender days unless an extension is requested and granted.

Deficiencies to be Corrected

See Attachment A

Signatories

Deficiencies To Be Corrected Date ____________

US EPA Representative Date

CDPHE Representative Date

[signature] 2-8-99

~~Construction Inspector~~ Date
SHATTUCK'S Representative PVR

FLUOR DANIEL GTI

January 28, 1999

James E. Hanley, P.E.
Environmental Protection Agency
Region VIII
999 Eighteenth Street, Suite 500
Mail Code: EPR-SR
Denver, Colorado 80202-2466

Dear Mr. Hanley:

Pursuant to the Unilateral Administrative Order for Remedial Design/Remedial Action dated August 21, 1992 (UAO), this letter certifies that the construction work at Operable Unit VIII of the Denver Radium Site is complete. This letter further certifies that the construction work performed by Fluor Daniel GTI was in accordance with the requirements of the UAO, the Statement of Work attached to the UAO and approved work plans.

COLORADO REGISTERED
MEI-BAN LO
31456
PROFESSIONAL ENGINEER

Sincerely,

M. B. (Ben) Lo, P.E.

Earth Sciences Consultants, Inc.
One Triangle Lane • Export, Pennsylvania 15632 • Phone: (724) 733-3000 • Fax: (724) 325-3352
Akron, Ohio • Denver, Colorado • Philadelphia, Pennsylvania

January 28, 1999

James E. Hanley, P.E.
Environmental Protection Agency
Region VIII
999 Eighteenth Street, Suite 500
Mail Code: EPR-SR
Denver, Colorado 80202-2466

Dear Mr. Hanley:

Pursuant to the Unilateral Administrative Order for Remedial Design/Remedial Action dated August 21, 1992 (UAO), this letter certifies that the construction work performed by Earth Sciences Consultants, Inc./AWS Remediation, Inc. at Operable Unit VIII of the Denver Radium Site was performed in accordance with the requirements of the UAO, the Statement of Work attached to the UAO and approved work plans.

Sincerely,

COLORADO REGISTERED HAROLD PARK McCUTCHEON 28597 PROFESSIONAL ENGINEER

Harold P. McCutcheon, P.E.
Director/Chief Engineer

Harding Lawson Associates

HLA

January 28, 1999

James E. Hanley, P.E.
Environmental Protection Agency
Region VIII
999 Eighteenth Street, Suite 500
Mail Code: EPR-SR
Denver, Colorado 80202-2466

Dear Mr. Hanley:

Pursuant to the Unilateral Administrative Order for Remedial Design/Remedial Action dated August 21, 1992 (UAO), this letter certifies that the construction work performed by Harding Lawson Associates (HLA) at Operable Unit VIII of the Denver Radium Site is complete. This letter further certifies that the construction work performed by HLA was performed in accordance with the requirements of the UAO, the Statement of Work attached to the UAO and approved work plans.

Sincerely,

J. Erich Rauber, P.E.
Principal

COLORADO REGISTERED
JOHN ERICH RAUBER
26647
1/28/99
PROFESSIONAL ENGINEER

SHATTUCK CERTIFICATION

The construction of the remediation at Operable Unit VIII of the Denver Radium Site was performed pursuant to the requirements of the Unilateral Administrative Order for Remedial Design/Remedial Action dated August 21, 1992 (UAO); the Statement of Work (SOW) attached to the UAO; and approved Remedial Design/Remedial Action (RD/RA) Work Plans.

The S.W. Shattuck Chemical Company, Inc. (Shattuck) has received a Notice of Final Completion Inspection signed by representatives of the Environmental Protection Agency and the Colorado Department of Public Health and Environment, which indicates that the construction is complete.

Based on the Notice of Final Completion Inspection and on the Contractor certifications of the construction, I hereby certify on behalf of Shattuck that, to the best of my knowledge, the construction of the remediation at Operable Unit VIII of the Denver Radium Site was completed in accordance with the SOW and the RD/RA Work Plans.

By: Robert H. Oliver

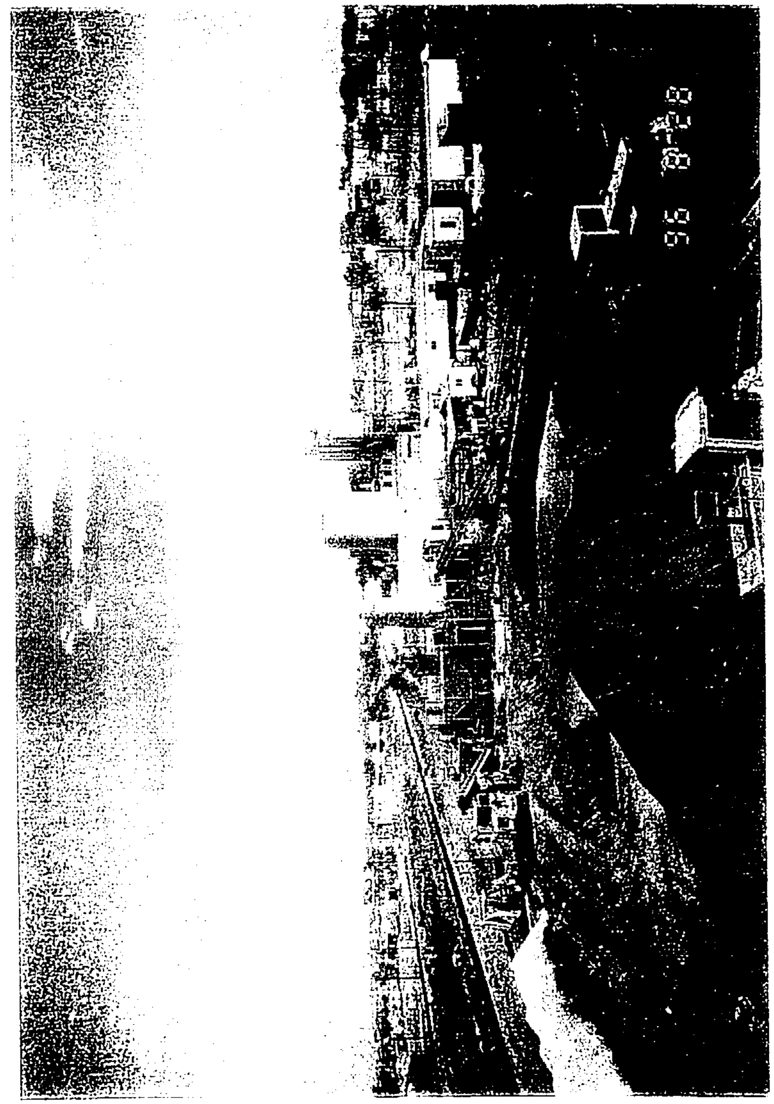
Title: EXEC. V.P.

Date: 1/25/99

Prepared monolith foundation (upper left)

Placement of S/S Materials (lower left)

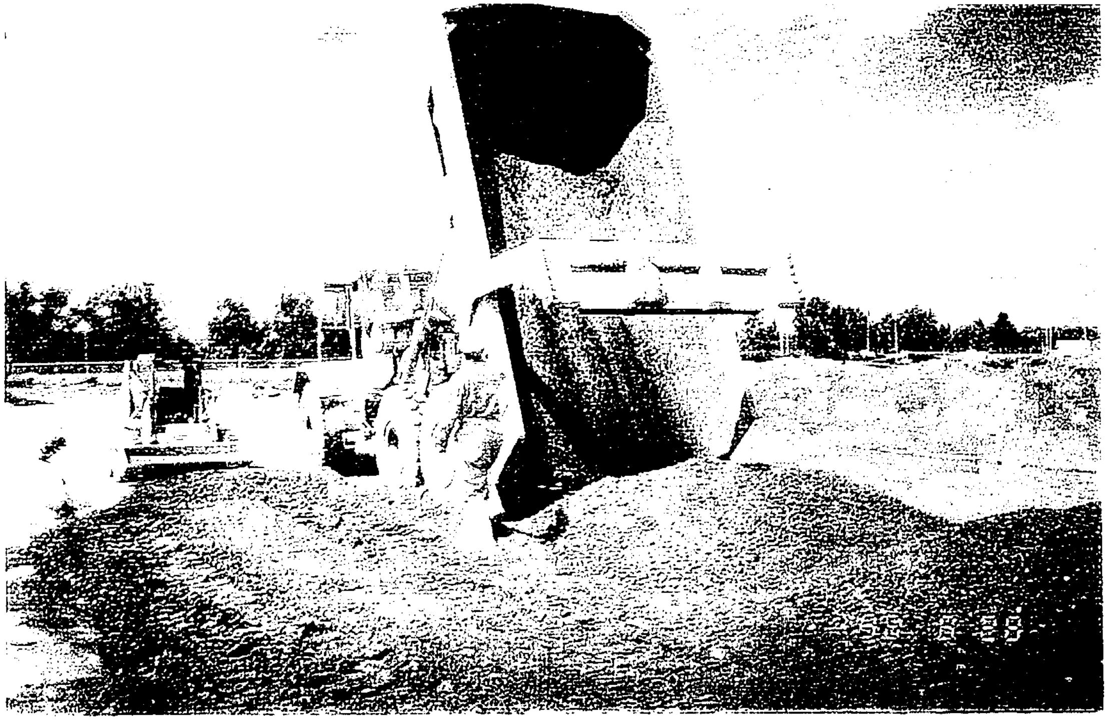
Excavation of AAL soil (above)



Spreading of S/S Material (upper left)

Excavation of AAL soil (lower left)

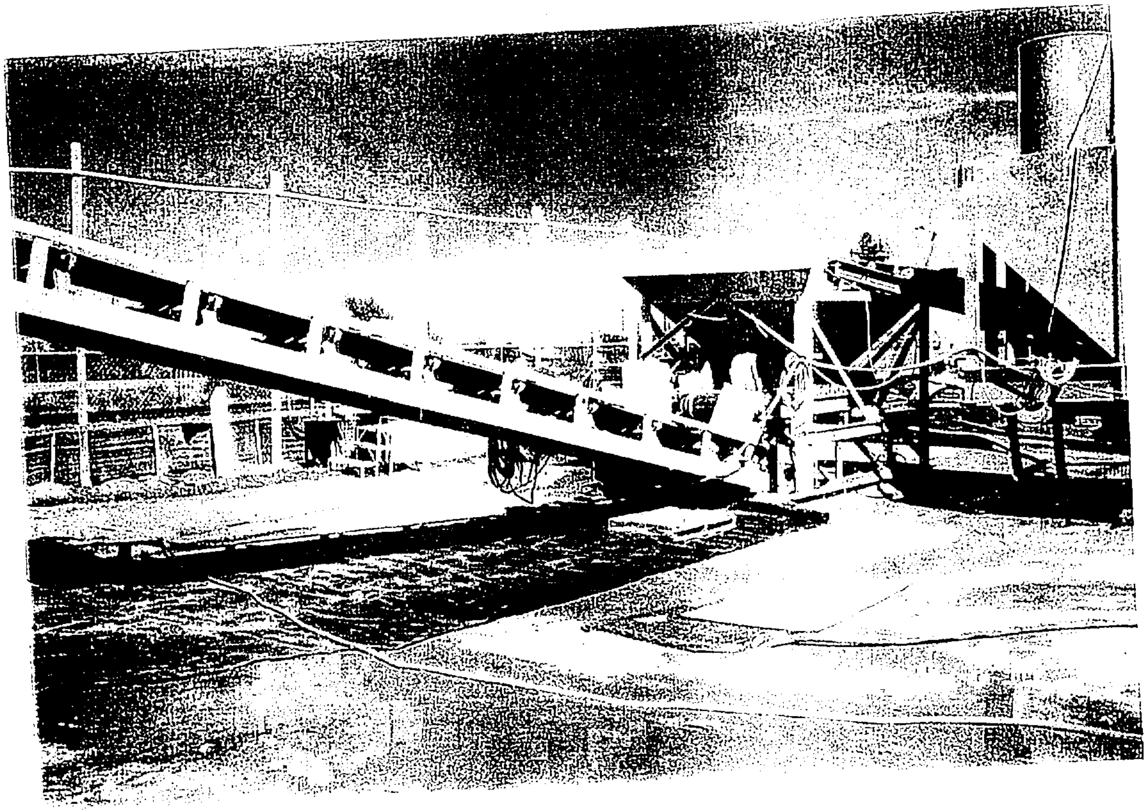
Soil stockpile and pugmill processing area
w/ Flanagan plant in background (above)



Dumping of S/S material (upper left)

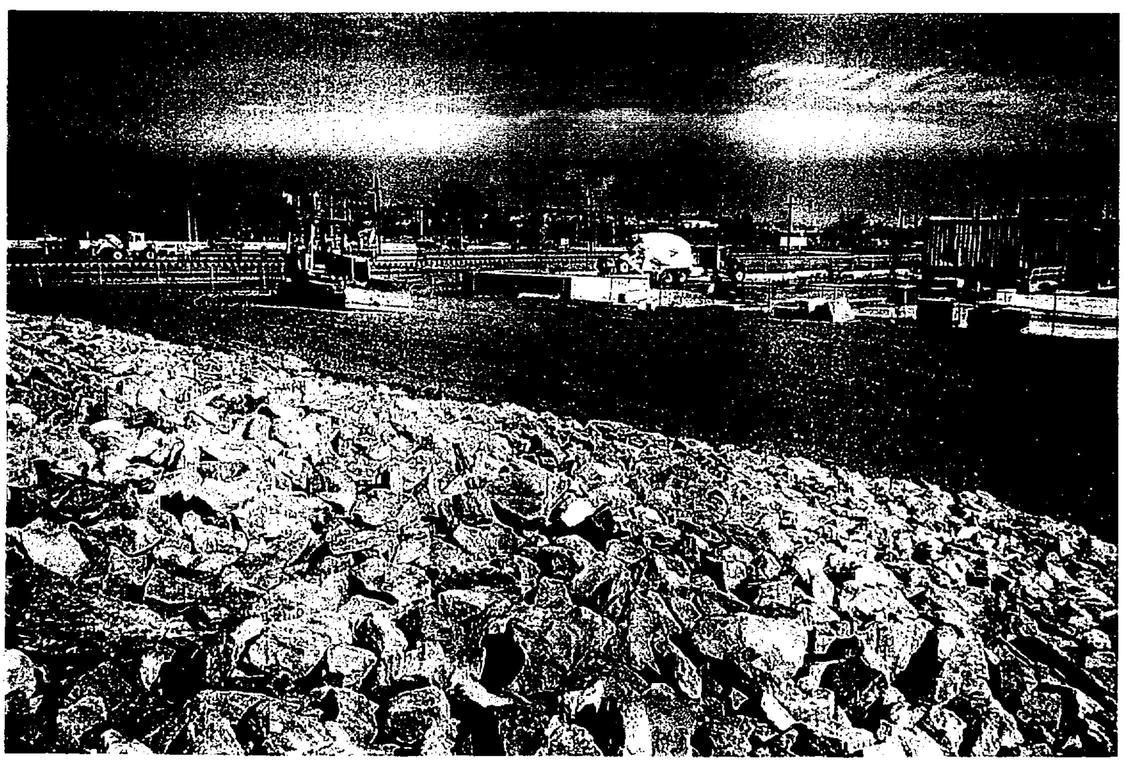
Compaction of S/S material (lower left)

Earth Sciences pugmill (above)



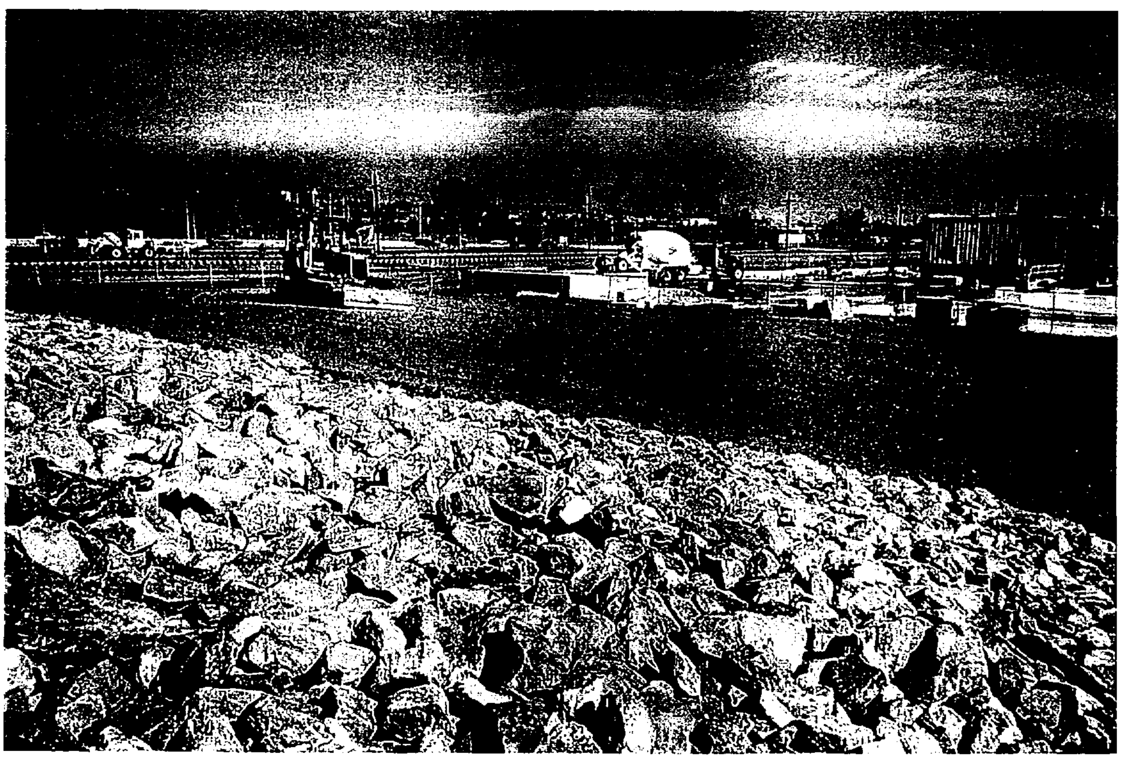
ESC/AWSR pugmill discharge hopper (upper photo)

Pugmill temporary enclosure (lower photo)



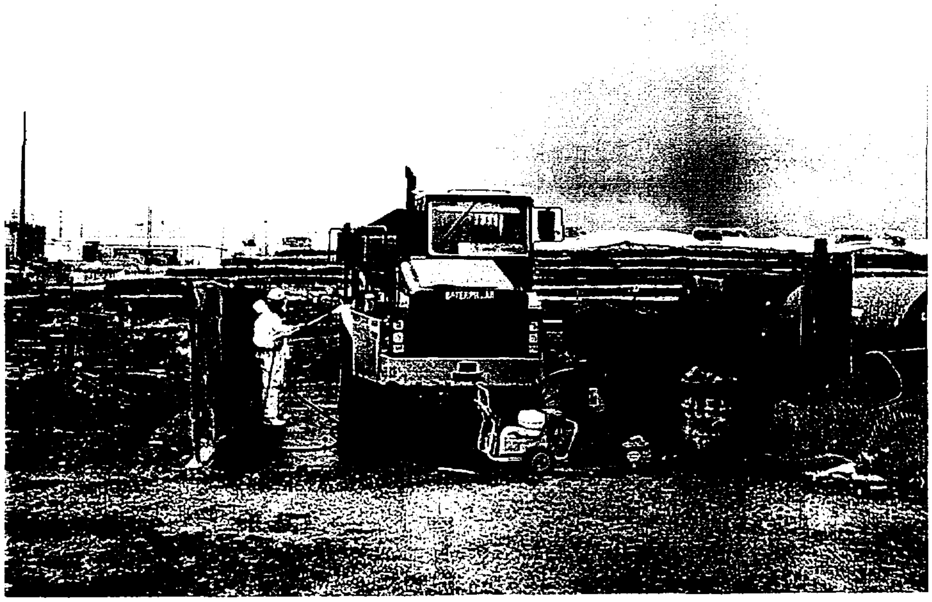
Placement of the rip rap toe drain
(upper photo)

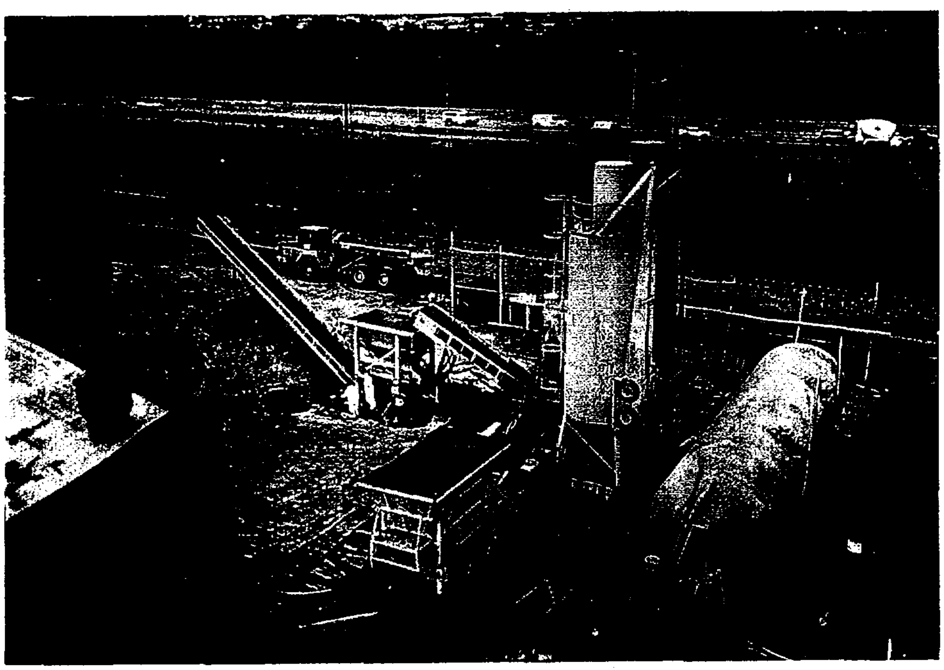
Finished rip rap and grading of north
end of Site (lower photo)



Placement of the rip rap toe drain
(upper photo)

Finished rip rap and grading of north
end of Site (lower photo)





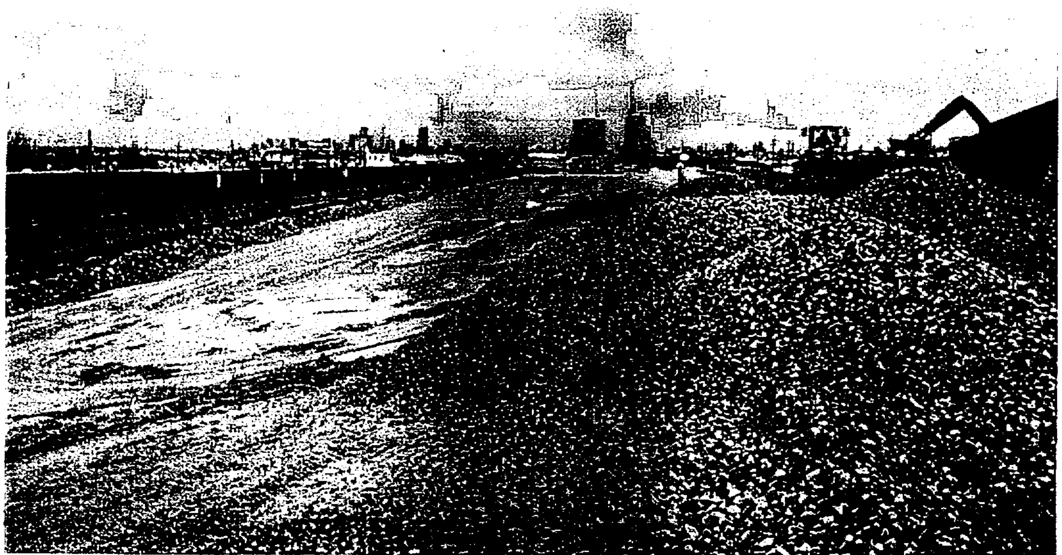
Equipment decontamination (upper photo)

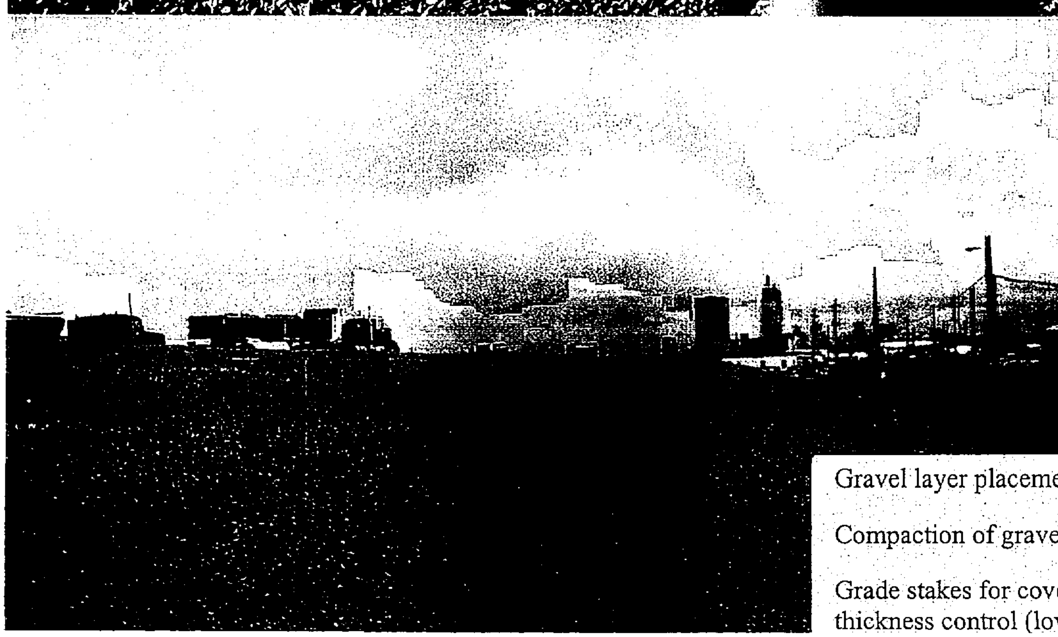
FD/GTI pugmill (lower photo)

Gravel layer of cover system (upper)

Rip rap placement (middle photo)

Setting grade stakes for riprap placement control (lower)

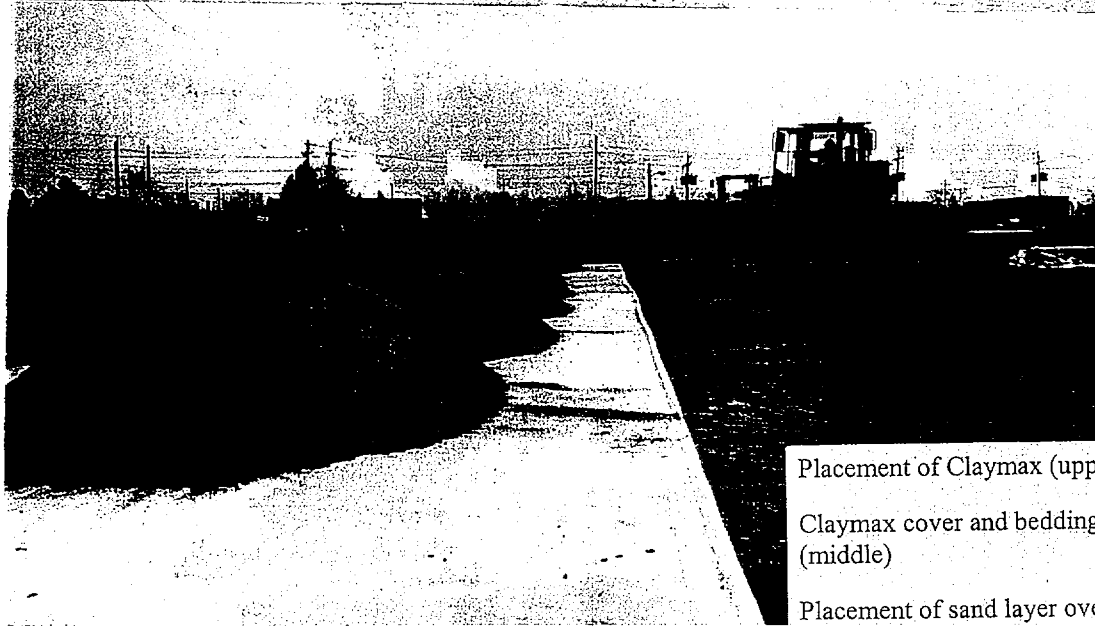




Gravel layer placement (upper)

Compaction of gravel layer (middle)

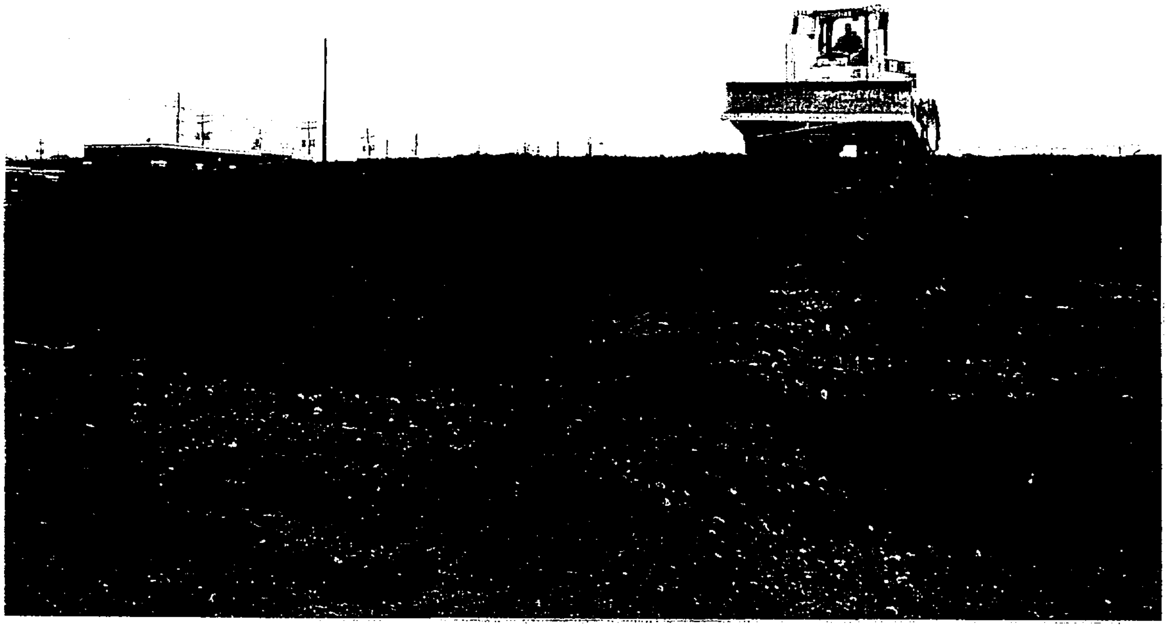
Grade stakes for cover system layer thickness control (lower)



Placement of Claymax (upper)

Claymax cover and bedding material (middle)

Placement of sand layer over Claymax



Grading of bedding material (upper)

Placement of bedding material (lower)